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INTRODUCTION

THIS book represents an attempt to meet the requirements of the Board of Education's Syllabus in Geography for Secondary Schools. It also attempts to provide candidates for the Junior and Preliminary Local Examinations of Cambridge and Oxford, and for the London University Junior School Examination, with a textbook in which they will find all the information usually required with reference to political and physical geography (treated on modern lines), and also information on such subjects as the making and reading of maps, the use of certain simple surveying instruments, methods of collecting data affecting climate, the use of such instruments as the sextant, etc., and the method of reading weather charts and forecasting the weather. The boy who works through this book will have made an elementary study of all the continents, of much of what is called physiography and commercial geography, and will have gained a practical acquaintance with many scientific instruments used in the study of geography. The book meets in the fullest manner the requirements of all Preliminary and Junior Examinations, and fits a boy for the more detailed study of the subject required for the Senior and Matriculation Examinations.

It is primarily intended for those schools taking the Board of Education's Course in Geography, and such schools should use the book as it stands, taking Parts I-III in three successive years. In the case of those schools whose work

INTRODUCTION

is determined by the University Local Examinations the matter required can be chosen from different parts of the book.

Owing to the arrangement of the subject matter that has been adopted, and to the omission of many details usually found in elementary textbooks but not required by the elementary student or the examiner thereof, space has been found not only to deal with a number of facts and to give reasons that will help the facts to be remembered, but also to deal with many of the scientific principles underlying such matters as the making of maps; the action of volcanoes and icebergs; the origin of tides, winds and currents; and other subjects usually relegated to a special work on "Physical Geography."

Information which can be obtained from a map is usually not given in the text, but deduced from a series of questions upon the maps themselves. In some cases this has been carried so far that it is impossible for a boy to read the text or to answer the questions set for home work without constant reference to a map. Many maps not to be found in an ordinary atlas, such as those showing the distribution of sheep, cattle, etc., the direction of isobars and isotherms for the different continents, have been inserted in the text so that they can be easily referred to.

The following extracts from the Board of Education's Regulations are in a way a synopsis of the book, and an account of some of the methods adopted and of the author's aims:—

"Before admission to the course scholars ought to possess a general elementary knowledge of the great landmasses of the world, the disposition of highlands and lowlands, the chief river valleys, and the names and positions of great countries and of a few of the chief towns in each. In addition a more detailed knowledge of the geography of the British Isles should have been attained. Throughout the preliminary Course great emphasis should have been laid on the interrelation of cause and effect. Scholars should also possess some knowledge of elementary Physiography, including the Earth's shape : simple map-making ; the compass ; day and

night and the seasons ; formation of mountains and rivers ; the oceans ; climate ; minerals ; plant and animal life."

As these remarks refer to work done in a preliminary course, they have no immediate bearing on this particular book. But it is quoted here as showing what kind of work ought to be done in the preliminary stages. It is quite possible to use this book with boys of from twelve years of age upwards who have had no such preliminary training, but the results will be all the more satisfactory if such preliminary training has been given. No better book for the preliminary student could be found than *Our Own Islands*, by Sir H. J. Mackinder (Philip).

"The time allotted to Geography should be not less than two periods of school-work and one of home work. One of the school periods should be largely devoted to dealing orally with exercises and home-work."

The author of this book thinks that there should be two periods of home-work, one of which should be devoted to some exercise in map-drawing. As the whole of the school-work should be oral and should deal with the material required for the exercises and the home-work, there seems little point in the second of the sentences in the paragraph quoted above.

"It is desirable that the teacher should frame for each Term a plan for the teaching of the selected portion of the subject, including the sections of the textbook used to supplement the oral instruction."

The readiest rough method is to find how many lessons can be given in a year and then divide the time equally among the lessons in the book, allowing sufficient time for revision at convenient intervals. Each part of this work contains about thirty-six chapters. As there are about thirty-six weeks in the school-year, there is ample time to go over the whole of the subject matter carefully and then to revise ; for many of these lessons would certainly not take more than one period of school-work, although in the earlier part of Part I two periods of school-work may have to be given to one chapter. For means of saving time in the drawing of curves and the use of blank maps, see "*Hints to Teachers*," published in a separate pamphlet.

"The aim of the teacher should be to produce a vivid impression of connected facts through considerations such as those of cause and effect and practical bearings of the facts selected."

A mere glance at the headings of the chapters will show how connected facts have been grouped, and in all cases it has been the author's aim to show the connection of cause and effect.

"Each scholar should possess an atlas. . . . Where the teacher has not . . . special knowledge textbooks should be chosen with special regard to succinctness, clearness, and accuracy. Teachers should accustom themselves to bring the information given on commercial and political geography up to date. Statistics, as such, should be avoided; but if they are used in the later years of the Course, they should be verified in round numbers by the teacher."

The author hopes that he is both clear and accurate. The book is certainly not overloaded with statistics. Teachers who require statistics for special purposes can usually obtain them from such books as the *Statesman's Year Book*, *Whitaker's Almanack*, etc. Certain statistical statements have, however, been given, but always with the object of showing how these can be represented in a striking manner by means of curves, diagrams, etc., which the pupil is expected to make for himself from the data provided.

"Wall maps should be large, clear, and up to date, and should be in constant use by the teacher."

The new "Comparative Series" of wall maps, published by Messrs. G. Philip & Son, are probably the best of their kind, and the author has had them constantly in his mind in writing this book.

"The scholars should be trained to follow the teaching each by means of his own atlas. Atlases should be simple, i.e., not crowded with names nor overburdened with detail of any kind; relative land levels and sea-depths should be indicated by colour gradations. For teaching of physical and commercial geography, separate maps should, if possible, be used."

For those who want a cheap atlas Philips' *Elementary Atlas of Comparative Geography* is recommended as

fulfilling the above conditions; but for those who can afford it the collection of maps, etc., from L'Estrange's Geography is the latest and best of modern atlases for school use. For not only is it clear and not overburdened with detail, etc., but it contains a unique collection of maps, showing for each continent the distribution of population, rainfall, winds, isotherms, etc., etc. The diagrams in the text of this book are useful, but they can never have the striking effect of the coloured diagrams from which they were made and which are contained in the above atlas.

"Globes of a suitable size for class demonstrations, diagrams, relief models, specimen products, photographs, and a collection of county and detailed maps for reference are recommended."

For hints as to the use of specimen products and the illustrating of the scholar's notes by photographs, picture-post cards, etc., see "Hints to Teachers" already referred to. Those wishing to obtain specimen products and photographs from other countries should communicate with Mrs. E. M. Ord Marshall of the League of Empire, Caxton Hall, Westminster, who will show them how such material can be readily collected. The author would add that much interesting work can be done by means of Underwood & Underwood's stereographic pictures. They are rather expensive, but the value of and the delight in their use cannot be overestimated.

"Questions and answers (graded in difficulty from year to year) designed to elicit, through causes and consequences, subject matter for entry in the scholar's notebooks. No facts should be stated without reasons; and the reasons are best expressed by the class itself."

A set of questions is appended to each lesson. In Part I these questions include map exercises, questions on the text and on the scholar's own neighbourhood. The questions have mostly been chosen from various examination papers, and the teacher will select those suitable to the age of his scholars or to the examination for which they are preparing. In Parts II-III the questions are as a rule arranged as follows: (i) Scientific; (ii) Revision question dealing with work learned in the First and Second Years;

(iii) A map exercise ; (iv and v) Exercises on the text of the particular section being studied at the time.

The letters O.S., C.S., etc., refer to the Oxford and Cambridge Local Examinations. The letters L.J.S. refer to the Junior School Examination of London University. The author wishes to acknowledge his indebtedness to the several universities for the permission given to him to make use of these questions.

"Scholars' notes should not contain merely the reproduction of lessons, but worked-out problems together with original maps and plans.

"Maps and diagrams should be regularly set, and in each case with a definite object, i.e., to illustrate a lesson from a particular point of view, physical, political, commercial, etc., no extraneous names or signs being inserted. Scholars should be required to justify each name, etc., inserted."

Maps illustrating definite objects are asked for in Part I chiefly in the Revision Exercises, because at this stage the time taken to do them in the lesson itself would be excessive. But in Parts II and III the illustrative maps are expected to be done in the lesson itself. Revision maps intended merely to fix in the mind the positions of important places are given in all the revision exercises in all three parts.

In conclusion the author wishes to acknowledge his indebtedness to two recent works, both of which ought to be in the hands of every teacher of geography no matter what textbook his class may use, viz., *A Course of Comparative Geography*, by L'Estrange ; and *Practical Geography*, by Simmons and Richardson.

E. Y

LOWER SCHOOL OF JOHN LYON,
HARROW.

A RATIONAL ~~GEOGRAPHY~~

PART II

CHAPTER I

THE GENERAL STRUCTURE OF THE EARTH

THERE are a certain number of planets that revolve round the sun as a centre. This system of sun and planets is called the Solar System. The largest planet of all is Jupiter, the volume of which is about 1,400 times that of the earth. The eight largest planets in order of their distance from the sun are Mercury, Venus, the Earth, Mars, Jupiter, Saturn, Uranus and Neptune.

The ancients thought that the earth was flat, and this is still the belief of many savage or semi-civilized people in distant parts of the globe. We now believe it to be round, for the following reasons :—

1. People have sailed round the earth in many directions. As a matter of fact they had to believe it was round before they made any attempt to sail round it.

2. Watch a steamer going from the shore. The hull disappears first and the tops of the masts last. Now the hull is much larger than the tops of the masts and, if the world were flat, the hull would remain in sight much longer than the smaller masts.

3. Attach three vertical poles to floats and put them about a mile away from each other on a perfectly straight canal. The three poles are of exactly the same length, and the middle pole is marked in inches. By means of a telescope look from the top of the first to the top of the third pole. If the surface of the water were quite level, the top of the middle pole would be in a line with the other two. But it is not. It rises about 8 in. above the line

joining the other two. When engineers are making canals or railway cuttings they allow 8 in. in each mile for the dip caused by the curved surface of the earth (Fig. 1).

4. From time to time the shadow of the earth is thrown

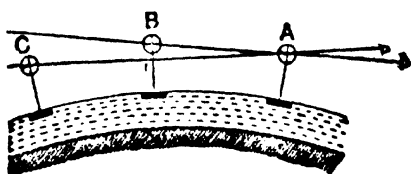


FIG. 1.
CURVATURE OF THE EARTH.



FIG. 2.—THE EARTH'S
SHADOW UPON THE MOON
DURING LUNAR ECLIPSE.

upon the moon. This shadow is always circular. The only body that can throw a circular shadow in all directions is a sphere (Fig. 2).

5. If you stand on a broad plain, you can see a certain portion of the earth's surface. The line which bounds your vision is circular in shape and is called the **horizon**. If you climbed a high tower at the same spot you would see more of the earth's surface, and your horizon would still be circular. And if you went up in a balloon you would see still more of the earth's surface, but your horizon would remain always a circular one. If you went to any other part of the earth's surface you would find that the same thing happened. There are many other curved bodies, such as a cylinder, or a cone, that have one or more circular horizons, but there is only one body whose horizon is circular, no matter from what point it may be viewed, and that is a sphere (Fig. 3).

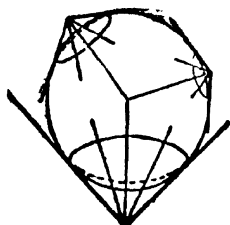


FIG. 3.
CIRCULAR FORM OF
HORIZON AT DIFFER-
ENT ALTITUDES.

6. It is known that the sun, the moon, and the other planets are all spherical, and so we conclude that our earth is spherical too.

7. In Europe, North America and Asia you can see on a starry night a group of stars called the Plough. Two of the stars that form the group (Fig. 4) are called the Pointers. They point very nearly in a straight line to a

bright star called the Pole Star. Now, if the world were flat, these stars would be visible on a clear night from all parts of the earth's surface. But it is found that as we travel towards the south, the Pole Star gets lower and lower in the sky, and that south of the Equator it disappears entirely. On the other hand, new groups of stars, not seen in Europe, come into view.

8. The sun does not rise at all places at the same time. If the world were flat, this would be the case.

Take an india-rubber ball, and pass a knitting needle through it, so that the needle passes through the centre of the ball. For the moment, imagine that this is a model of the earth and that the knitting needle is the **axis** of the earth. The points where the needle projects are called the **Poles**. With a piece of chalk draw a line round

the ball half-way between the poles. This line is the **Equator**. Now draw another chalk line passing round the ball and through the two poles. How many such circles could you draw passing through the poles and right round the ball? Such circles are called **great circles**. Measure the two circles you have drawn with a piece of string. You will find that they are equal in length.

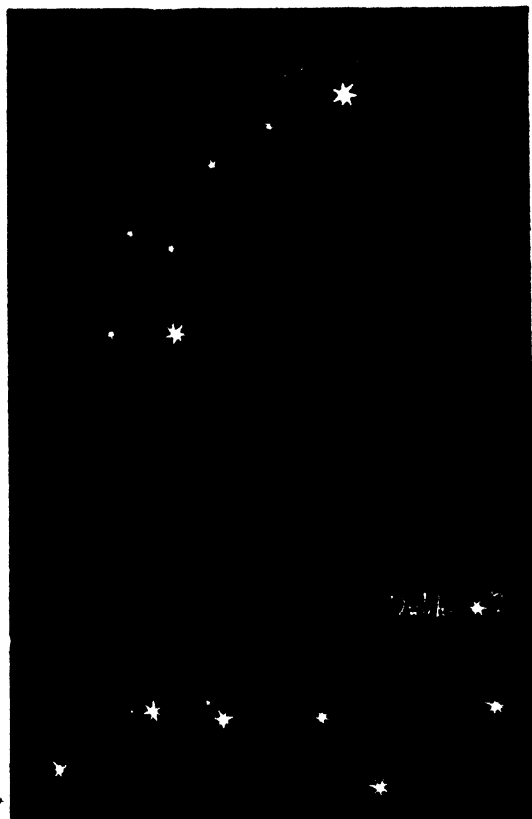


FIG. 4.—STAR GROUPS, SHOWING HOW TO FIND THE POLE STAR.

A RATIONAL GEOGRAPHY

But if you were to measure the distance round the world in this way the circumferences of the two circles would not be equal. The distance round the world when you pass through the poles is 42 miles less than when you go round the earth along the equator. In the same way, if you measure the distance through the world from pole to pole and also the distance through the centre of the earth from a point on the equator to another point on

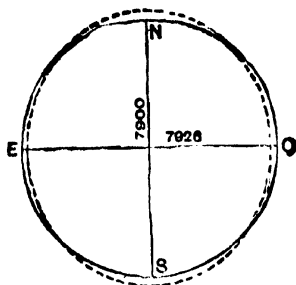


FIG. 5.—SPHEROIDAL FORM OF THE EARTH.

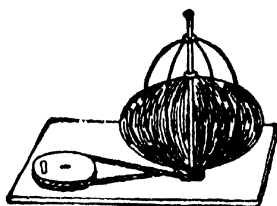


FIG. 6.—EXPERIMENT TO ILLUSTRATE THE PRODUCTION OF A SPHEROIDAL FORM BY ROTATION.

the equator directly opposite to it, you will find that the first distance is 26 miles shorter than the second. The Polar diameter is 7,900 miles long, and the Equatorial diameter is 7,926 miles long. It is evident that the world is flattened a little at the poles and bulged a little at the equator. Such a shape as this is called an **oblate spheroid**, that is, a flattened sphere-like body. The distance round the world is about 25,000 miles. The distance through it is about 8,000 miles (Fig. 5).

In Fig. 6 you have a sketch of an apparatus for making two circles of flat wire revolve very rapidly. When the circles are rapidly revolved they appear to assume the shape shown by the shaded figure. It is believed that ages and ages ago the earth was a mass of semi-fluid material which was revolving in space. While in this condition, as it revolved, it would, like our wire circles, have a tendency to slightly flatten at the poles and bulge at the equator.

The earth appears to us to have cooled down by now,

THE GENERAL STRUCTURE OF THE EARTH 5

but it must still be intensely hot at the centre. When mines are made, it is found that the deeper you go, the hotter it gets. At one of the Wigan collieries (where is Wigan ?) the following figures were obtained.

Depth of Mine.	Temperature.
564 feet	66° F.
1 674 „	78° F.
2,013 „	86° F.
2,445 „	94° F.

The temperature as a rule increases about 1° F. for every 60 or 70 ft. of descent. The water taken from very deep wells is always warmer than that near the surface. At Grenelle, near Paris, there is a well which is about 1,800 ft. deep. The temperature of the water taken from it is 82° F. We have also hot springs in England, the waters of which must derive their heat from the interior of the earth.

Bath, 120° F.

Buxton (Derbyshire), 82° F.

In Iceland there are springs of hot water that rise like great fountains from the ground. They are called **geysers**. The Great Geyser has a temperature of 190° F.

No one knows what is the condition of things at the centre of the earth. The temperature is probably great enough to melt the most solid rock, but at the same time the pressure of the outer parts of the earth upon the parts nearer the centre must be so enormous, that it is very improbable that any melting actually occurs.

REVISION EXERCISES

1. Explain the terms : glacier, geyser, isthmus, iceberg. O. J., 1894.
2. Name four important ports on the South Coast of England ; describe their positions, and state in what way each of them is important.
C. P., 1905.
3. Draw a map of North America. Mark Cape Cod, Chesapeake Bay, Long Island, the states Georgia and Maine, the district of Columbia ; the Dismal Swamp of the Everglades ; the towns Boston, Richmond, Charlestown, and Halifax.
O. J., 1906.
4. What and where are the chief English coalfields north of the Trent ?

What are the chief industries carried on round any one of these coalfields Give any reasons you know for such industries being carried on there.

L. J. S., 1906.

5. Describe the situations of Cardiff, Harwich, Plymouth, and Southampton; and account as far as you can for the importance of each.

L. J. S., 1906.

CHAPTER II

LATITUDE AND LONGITUDE

TAKE a piece of squared paper and on it draw two lines at right angles, crossing at a point O. Call the vertical line NOS, and the horizontal line WOE. It is required that you shall place a certain point A in the diagram you have just drawn. This point A lies on a line *half an inch* from the line NS. Draw two lines, one on each side of NOS, parallel to it, and at a distance of *half an inch* from it. The required point is somewhere on one of these two lines, for every point on each of the lines is *half an inch* from NS. It is known that the point A is also *one inch* from the line WOE. Draw two lines parallel to EW, one on each side of it, and at a distance of *one inch* from it. A lies on one of these lines, and it also lies on one of the other two lines. It may therefore be in one of four positions. Mark with dots the four possible positions of A. Only one of these points is the required one. It is known that A lies *above* the line WOE. How many possible positions are there now? The point A lies to the *right* of NOS. How many points fulfil all the required conditions?

To define the position of a point we require to have two fixed lines, to know the distances of the point from these lines, and also to know on which side of each line the point lies. Positions above the line WOE are called north, and those below it south. Positions on the right-hand side of NOS are called east, and those on the left hand west. Take another piece of squared paper. Rule on it two lines at right angles, and mark the positions of the following points:—

2 N 3 E ; 2 N 4 W,
 3 S 3 E ; 2 S 4 W,
 3 N 5 E ; 7 N 2 W,
 4 S 3 E ; 4 S 4 W.

Find the position of 0, N 2 E, and 0, N 3 W. On what line do all places 0, N lie ? All places 0, S ? 0, E ? 0, W ?

The positions of places upon the earth's surface are found in a similar way, but the distances are measured in degrees.

Draw a circle. Through its centre O, draw two diameters at right angles, N S, and E W. The angles at the centre of the circle, viz., N O W, S O E, S O W, N O E, are right angles. There are then four right angles at the centre of every circle. A right angle contains 90° , so that there are 360° in every circle. There are 90° from N to E, or from E to S, or from S to W, or from W to N.

Take your india-rubber ball, on which you have already drawn the equator and one great circle through the poles. These two circles cut each other. Any point on the Equator is 0° N., or 0° S. A point 90° N. is the North Pole. If it is 90° S. it is the South Pole. Can you get more than 90° N. or S. of the equator ? Try on your ball. The great circle through the pole cuts the Equator in two points. There are 180° from the one point to the other. Suppose a point were 0° E., where would it be ? 0° W. ? 180° E. ? 180° W. ? Can you go more than 180° E. or W. of your great circle ?

Suppose there is a mass of lost treasure hidden in a certain spot in this world, and that you have to find it.

The spot is south of the Equator. It is 45° from the Equator. Find a point on your great circle half way between the equator and the south pole. That is one point that is 45° S. Through this point, draw a circle parallel to the equator. Every point on that circle is 45° S. of the equator. You do not want to sail all round the world. So you ask whether it is east or west of the great circle through the poles. It is east. How far east ? 60° .

Start at the point where the great circle cuts the equator (60° = one-third of 180°). Measure off one-third of the

semi-circle. The point you have found is on the equator and 60° from the fixed line. Through this point draw a great circle passing through the poles. Now, if the spot where the buried treasure lies is both 45° S. and 60° E., where is it?

Mark on your ball the following points, which you will find by following the above method.

30° N. 60° E., 30° N. 30° E.

60° S. 60° W., 60° S. 30° W.

Distance north or south of the Equator is called **latitude**. The circles drawn parallel to the equator are called **parallels of latitude** (Fig. 7).

Distance east or west of a fixed line is called **longitude**.

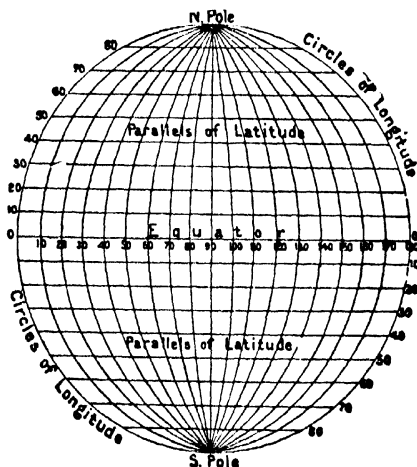


FIG. 7.—PARALLELS OF LATITUDE AND LONGITUDE.

The great circles drawn through the poles are called **meridians**. The one drawn through Greenwich is called the **First Meridian**, and it is from this line that we measure all longitude.

Examine a globe and answer the following questions.

Is London in north or south latitude? Paris? New York? San Francisco? Rio de Janeiro? Cape Horn? What is the latitude of the Equator? of the North Pole? of the South Pole? Is Paris in east or west longitude? Dublin? Cape Town? Cairo? New Orleans? Edinburgh? Jamaica?

The meridians are widest apart at the Equator. At

the poles they intersect. One three hundred and sixtieth part of the Equator, that is, one degree of longitude at the Equator measures 69 miles, but one degree of longitude at London measures only 43 miles.

If you stood at the North Pole and obeyed the command "Right about ; turn," through how many degrees of longitude would you turn ?

Degrees are divided into smaller divisions, called **minutes**, and minutes are divided into **seconds**.

60 seconds make 1 minute.

60 minutes make 1 degree.

90 degrees make 1 right angle.

For these divisions, the following signs are generally employed : " for seconds, ' for minutes, and ° for degrees.

There are about 25,000 statute miles in the circumference of the world. There are 360° of latitude. About how many statute miles are contained in 1° of latitude ? As the world is not perfectly round the length of the degree of latitude varies as shown in the following table.

Latitude.	Length of 1°.
0°	68·70 statute miles
10°	68·72 "
20°	68·78 "
30°	68·87 "
40°	68·99 "
50°	69·11 "
60°	69·23 "
70°	69·32 "
80°	69·39 "
90°	69·41 "

One minute of latitude is a sea mile.

There are 360° in the Equator, and its length is about 25,000 statute miles. What is the length of a degree of longitude at the Equator ? A parallel of latitude farther north is shorter, but it still contains 360° of longitude, and as we have already pointed out the degree of longitude becomes much shorter as we reach the poles. The following table shows some of the differences.

Latitude.	Length of 1° of Longitude.
0°	69·17 statute miles
10°	68·13 "
20°	65·03 "
30°	59·96 "
40°	53·06 "
50°	44·55 "
60°	34·67 "
70°	23·73 "
80°	12·05 "
90°	0·00 "

Find on a map or a globe the following places from the data given. Enter the names and figures in a table as shown.

Latitude.	Longitude.	Place.
51° 30' N.	0° 5' W.	
37° 58' N.	23° 45' E.	
31° 12' N.	29° 53' E.	
34° 35' S.	58° 21' W.	
30° 2' N.	31° 15' E.	
10° 30' N.	66° 54' W.	
53° 23' N.	6° 20' W.	
55° 57' N.	3° 11' W.	
44° 39' N.	63° 35' W.	
23° 9' N.	82° 22' W.	
55° 59' S.	67° 16' W.	
15° 20' N.	32° 42' E.	
6° 26' N.	3° 26' E.	
12° 3' S.	77° 6' W.	
40° 25' N.	3° 40' W.	
17° 27' N.	88° 12' W.	

Find from the map the latitude and longitude to the nearest degree of the following places.

Paris.

Berlin.

Vienna.

Algiers.

Cape Town.

Cape Sable.

Cape Race.

Valparaiso.

Quito.

Chimborazo.

Find on the globe the latitude and longitude of the following places.

Rome.	Philadelphia.
Moscow.	Cape St. Roque.
Cape Verde.	Rio Janeiro.
Teneriffe.	New Orleans.
Ottawa.	Chicago.

What meridian line passes through Berwick-on-Tweed and Poole? Name in order from north to south the counties it crosses, and give the chief town of each.

Give similar particulars, in order from east to west, in the case of a straight line drawn between Wexford and Tralee. C. S., 1888.

Give approximately the parallels of latitude between which lie the basins of the Mississippi and the Nile respectively. C. S., 1889.

Name the countries and seas through which the meridian of Greenwich passes.

Give the longitude of the points where the Equator cuts the coastline of Africa and South America.

The following meridians pass through certain British possessions. Fill in the names of these possessions.

Meridian.	British Possession.
2° 7' W.	
5° 21' W.	
14° 30' E.	
20° E.	
30° E.	
0°	
66° W.	
82° W.	
77° W.	
59° W.	

Name in order the countries, seas, and islands through which the Equator passes, beginning at the meridian of Greenwich and going eastward all round the world. Mention any towns situated on or near the Equator. C. S., 1894.

REVISION EXERCISES

1. Define latitude and longitude. State approximately the latitude of Adelaide, Victoria Nyanza, Madrid, Petrograd, San Francisco, Calcutta; and the longitude of Alexandria, Bordeaux, New Orleans, Madras, Yokohama. C. S., 1890.

A RATIONAL GEOGRAPHY

2. Contrast the configuration of the east and west-coasts of Scotland. Where is (a) Strath Spey, (b) Ben Lomond, (c) the I. of Mull, (d) the Esk ?

O. S., 1888.

3. Draw a map of South America, inserting the Andes with Mounts Sorata and Cotopaxi ; the rivers Amazon, Parana, and Orinoco ; the towns of Pernambuco, Caracas, Cuzco, Rio de Janeiro, Asuncion. Mark the boundaries of Chile and of British Guiana.

C. J., 1893.

4. "There exists a reason for the position and development of every town in whatever part of the world it may be situated."

Illustrate this statement in the following cases : Hamburg, Aachen, Strassburg, Frankfurt-on-Main, Cologne, Essen, Kiel.

O. S., 1905.

5. Describe the watershed of the Thames basin and point out where it runs along ridges.

L. J. S., 1906.

CHAPTER III

SUN AND SHADOW

THE practical exercise with which this lesson commences must be performed on a day when there is sunshine. If sunshine is not available then this part of the lesson must be postponed. Place a stick upright in the ground in some convenient part of the school premises where it will be safe from disturbance. Measure and note carefully the height of the portion of the stick above the ground. The length of the shadow is to be observed every half-hour from 9 a.m. to 3 p.m. and the results written down in column II of a table similar to the following one :—

Time of Day.	Length of Shadow.	Altitude of the Sun.
9.0 a.m.		
9.30 "		
10.0 "		
10.30 "		
11.0 "		
11.30 "		
12.0 "		
12.30 p.m.		
1.0 "		
1.30 "		
2.0 "		
2.30 "		
3.0 "		
3.30 "		

Perform the measurements before the day of the actual lesson.

If your stick is on asphalte, mark the ends of the shadows with chalk. If the stick is on the grass mark the ends of the shadows with small pegs of wood, so that, at 3 o'clock you can go out and see the various positions taken by the shadows.

When was the shadow shortest? Suggest a reason for this. The direction in which the shadow falls at noon, is, in England, **due north**. The sun itself is at the same time, **due south**. If the shadow line at noon were continued in both directions it would pass round the earth through the two poles. Notice that the north and south line obtained in this way is not that given by the compass, for the magnetic north pole is not at the geographical north pole. The line obtained in the way indicated above is called the **meridian** of the place where the observations were made. If you stand on the meridian with your face to the north, and draw a line at right angles to the line of the meridian, the line will point **due east** on the right hand, and **due west** on the left hand.

It is not really very easy to find the meridian in this way, because it is not always possible to tell exactly when the shadow is shortest. The following method will help you to find the meridian without having to find the position of the shortest shadow.

Measure the length of the shadow at nine o'clock. Mark its position on the ground. Take a piece of string and make a loop in one end. Slip this loop over the stick and bring it down to the level of the ground. Using the length of the shadow at nine o'clock as a radius, draw a circle with the stick as centre. At three o'clock the shadow will touch the circle again, on the other side of the stick. Mark its position. From nine till twelve, the shadow grew shorter. From twelve till three it grew

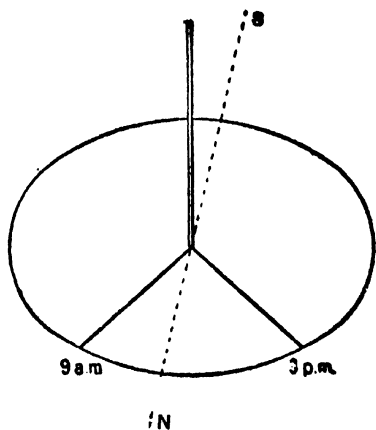


FIG. 8.—MEASUREMENT OF THE SUN'S SHADOW.

longer again. Bisect the angle between the two lines and the bisecting line gives you the position of the **north and south** line.

Next notice the shape of the line connecting the ends of the shadows. If you drew the shadows in chalk, join their ends by a chalk line. If you marked them with pegs,

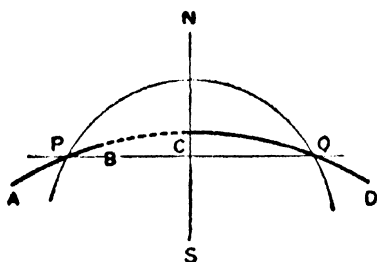


FIG. 9.—METHOD OF TRACING THE SUN'S SHADOW ON A CLOUDY DAY.

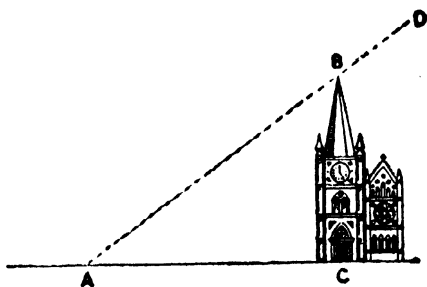


FIG. 10. — THE ALTITUDE OR ANGULAR HEIGHT OF THE SUN ABOVE THE HORIZON.

draw a piece of string round the pegs. What is the shape of the line? Such a line as this is called the **trace** of the shadow.

Suppose that the day is a cloudy one. Then, at some of the half-hour intervals it will not be possible to find any shadow at all. Your trace will be a broken one. Let AB, CD, be the parts of the trace that you have obtained. Let S be the position of the stick. With S as centre and any convenient radius draw a circle cutting the trace at P and Q. Join PQ. Draw SN at right angles to PQ and you have the meridian required.

Measure at noon, every day for the next twelve months, the length of the shadow cast by the same stick in the same place. These lengths are to be plotted on squared paper and joined by a curve. Fasten up the paper in the classroom, and observe how the length of the shadow changes from day to day.

Let BC be a church tower and D the position of the sun. Join D to B by a straight line and produce it to meet the ground line at A. The length AC is the length of the shadow of the church tower at this time. The angle BAC is said

to be the angular height of the sun above the horizon, or its **altitude**.

Take a piece of squared paper. On some convenient scale draw a figure like that shown. AC represents the stick in the school playground. BC represents the length of

the shadow at, say, nine o'clock. Find the angle CBA, that is, find the altitude of the sun. (Use a protractor.)



FIG. 11.—THE ALTITUDE OF THE SUN

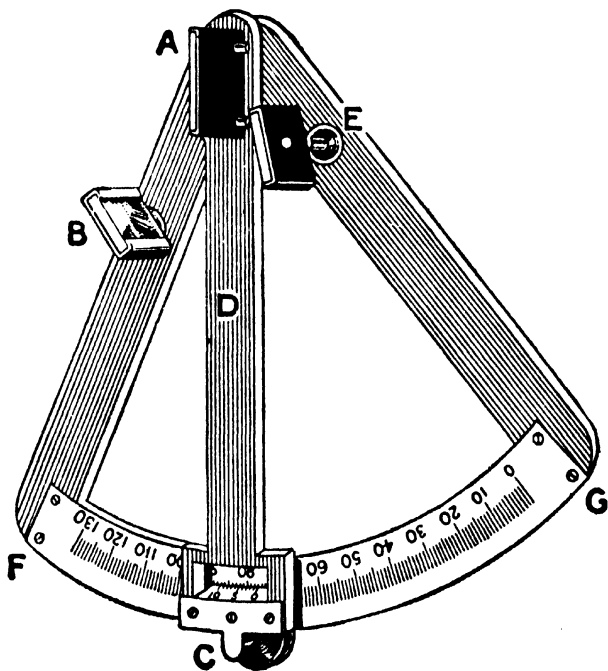


FIG. 12.—SEXTANT.

Do this for every one of the measurements you have made throughout the day and enter the results in the third column of your list of shadow lengths. As the shadow shortens does the altitude of the sun increase or decrease?

Sailors require to know each day the altitude of the sun,

For this purpose they use an instrument called a **sextant**.¹ A simplified form of this instrument is shown in Fig. 12. It consists of a sector of a circle with a graduated arc of 60° . Attached to the sector is a small plate with a hole in it, E. There is a movable arm D, to one end of which a mirror A is fixed. At B there is another piece of glass. One half is silvered and the other half is plain. Dark glasses are provided to put over the hole at E *for it is very dangerous to look at the sun with the naked eye.* At C, there is a vernier which assists in reading accurately the angles that have to be observed. Set the movable arm D opposite the

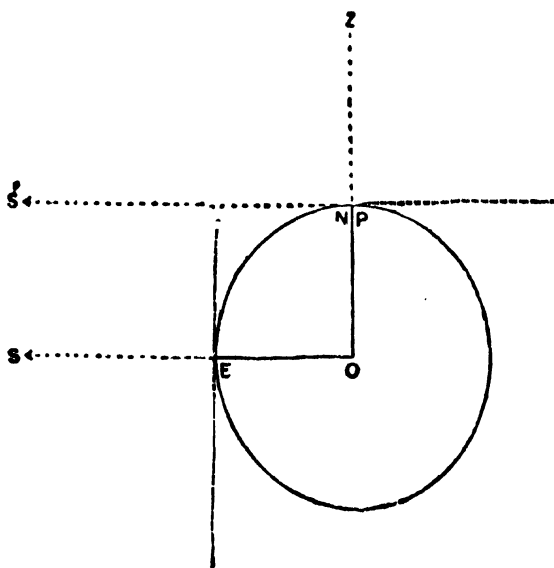


FIG. 13.—THE ZENITH.

zero of the arc F G. Notice that in this position the mirrors at A and B are parallel.

Look through E and B at the horizon. Then suppose you require the angular altitude of a chimneypot or a steeple. Move the movable arm until you can see the image of the top of the object on a level with the horizon. Read the angle through which the arm has been moved. This gives the angular altitude of the object.

¹ The sextant shown in Figure 12 is a simple form, suitable for school use, and is made by Messrs. P. Harris & Co., Birmingham.

Find the altitude of the sun in the same way *but do not forget the dark glasses*. In future, measure the altitude of the sun daily at noon and keep a record of the results.

Why does a sailor require to take the altitude of the sun ?

Consider Fig. 13. O is the centre of the earth. E is the position of an observer on the Equator. S is the sun. At noon, the man looks straight up and sees the sun above his head. The point directly above his head is called the **zenith**. (The point directly opposite to this on the other side of the globe is called the **nadir**.) The sun is in the zenith. Imagine a line drawn from the man to the zenith and another one drawn from the man to the centre of the sun. They will form one straight line. There is no angle between them. The angular distance of the sun from the zenith is 0 degree and the man's latitude is 0 degrees.

Imagine an observer at the North Pole. His zenith is at Z. The sun is at S' and is so far away that its rays may be considered parallel. Now what is the angle between the lines joining the man to the zenith and to the centre of the sun ? It is 90° . What is the latitude of the North Pole ? It is 90° also, and so it can be proved in other positions, that if you draw lines from the observer to the zenith and from the observer to the sun the angle between these lines gives the latitude of the place. But as it is not easy to tell where the zenith is, we measure the distance of the sun above the horizon and not its distance from the zenith. At the Equator the distance of the sun at noon from the horizon is 90° . Subtract this from 90° and the result is 0° which is the latitude of the Equator. At the North Pole the distance of the sun from the horizon is 0° . Subtract this from 90° and the result is 90° , which is the latitude of the North Pole. Similarly if the altitude of the sun at noon at your school is 49° then your latitude is $90^\circ - 49^\circ = 41^\circ$. We have here assumed that the sun is always over the Equator at noon. This however only happens twice in the year. We shall return to this subject in a later chapter, and shall then explain how the latitude can be found on those days on which the sun is not over the Equator. The latitude of a place north of the Equator

can be found at night by observing the altitude of the Pole Star.

The Pole Star is almost directly over the North Pole. If you were at the North Pole the distance from the Pole Star to the horizon would be 90° , which is the latitude of the North Pole. At the Equator the Pole Star is seen on the horizon. Its distance from the horizon is 0° , which is the latitude of the Equator. Similarly if the altitude of the Pole Star at your school is 51° your latitude is 51° . Find the latitude of your school in this way on a bright night.

REVISION EXERCISES

1. A traveller in an unexplored region wishes to find the north and south line passing through a place where he encamps. Describe any approximate method by which he could do this. Why could he not make use of the compass? O. J., 1905.

2. (a) Draw a sketch map of Ireland showing the four provinces, Malin Head, Lake Derg, Dundalk, Bantry Bay, River Suir, Valentia Island, Castlebar, Drogheda, Slieve Bloom Mountains.

(b) What are the chief industries of Belfast, Waterford and Limerick? O. J., 1894.

3. Draw a map of the Dominion of Canada. On it mark the political divisions, the courses of the Mackenzie, Athabasca, and Saskatchewan rivers; Mount St. Elias; Ottawa, Halifax, Regina, Montreal, Winnipeg, New Westminster, Port Arthur, Calgary. C. J., 1891.

4. Explain how you would find the Pole Star, and how, having found it, you could determine your latitude. C. S., 1905.

5. What is meant by the terms "nadir" and "zenith"? At what part of the earth would an observer see the Pole Star in his zenith? C. J., 1894.

[A very cheap form of a modified sextant (an anglometer) is made by Becker & Co. Its cost is only 2s. 9d. and with it much practical work in geography, surveying, etc., can be done. Full instructions are supplied with the instrument.]

CHAPTER IV

ROTATION OF THE EARTH

IN olden days men believed that the earth was a great plane in the middle of the universe. They saw that the sun rose in the east in the morning and set in the west in the evening, and they came to the conclusion that it moved round the earth in a circle.

We now know that the apparent movements of the sun are caused by the real movements of the earth. The earth revolves in space at a distance of 93,000,000 miles from the sun. It also spins round on its own axis, making a complete rotation in *about* 24 hours.

The path of the earth round the sun is called its orbit. It is an ellipse in shape, so that the earth is nearer the sun at one time than it is at another. The sun is not in the centre of the ellipse but to one side. When the earth is nearest the sun it is said to be in **Perihelion**. When it is furthest away from the sun it is said to be in **Aphelion**.

Imagine a flat sheet of metal passed through the earth, cutting it in two, along the Equator. This is the plane of the Equator. Imagine another flat sheet to pass through the centre of the sun and the centre of the earth and to cut the earth's orbit at all points. This is the plane of the **ecliptic**. Now as the earth travels in its orbit, its axis is not in an upright position. It is tilted as shown in the figure. You will see that the plane of the ecliptic and the plane of the Equator cut one another at an angle of $23\frac{1}{2}^{\circ}$. The earth's axis makes an angle of $66\frac{1}{2}^{\circ}$ with the plane of the ecliptic. It is at right angles to the Equator, and is always directed to the same point in the heavens.

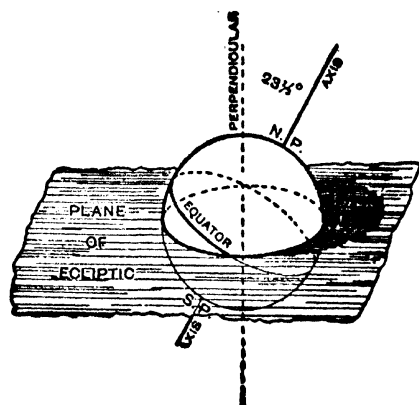


FIG. 14.

INCLINATION OF THE EARTH'S AXIS
TO THE PLANE OF THE ECLIPTIC.

Pull down the blinds of the classroom. Put a lighted lamp and a globe on a table, so that the centre of the light is on a line with the centre of the globe. How much of the ball is in shadow? how much in light? Turn the ball round. Does the total amount of light and shadow on the globe change? Suppose the globe to be the earth and the lamp to be the sun. Those parts of the earth that are in shadow are having their night time, but wherever there

is light it is daytime. What would happen if the sun and the earth were to stand perfectly still ?

The daytime is not always of the same length. In summer you can read without a lamp until late in the evening. In the winter it is dark at quite an early hour. The following figures give the times of the rising and the setting of the sun on certain days of the year in the neighbourhood of London.

Date.				Sunrise.		Sunset.		Length of Day.
				H.	M.	H.	M.	
Jan.	1	.	.	8	8	3	58	
Feb.	1	.	.	7	42	4	46	
Mar.	1	.	.	6	49	5	36	
Mar.	21	.	.	6	5	6	11	
April	1	.	.	5	39	6	29	
May	1	.	.	4	35	7	19	
June	1	.	.	3	50	8	3	
June	21	.	.	3	44	8	19	
July	1	.	.	3	48	8	18	
Aug.	1	.	.	4	23	7	49	
Sept.	1	.	.	5	13	6	48	
Sept.	23	.	.	5	44	6	2	
Oct.	1	.	.	6	0	5	40	
Nov.	1	.	.	6	54	4	34	
Dec.	1	.	.	7	45	3	53	
Dec.	21	.	.	8	5	3	51	

Fill in column four, showing the length of the day on the days given. Plot a curve to show the lengths of the days. Plot the dates horizontally and the hours of daylight vertically. Produce your vertical lines so that this total length represents 24 hours and completes the rectangle. Turn the figure upside down. What does the curve represent now ? Shade the area enclosed by the curve which represents the variation in the hours of darkness.

We have now to explain why the days vary in length in the way shown above (Fig. 15).

Consider the position of the earth with regard to the sun on four different dates as shown in the diagram. The chief points to bear in mind are that the axis of the earth

is not upright, that the plane of the Equator cuts the plane of the ecliptic at an angle of $23\frac{1}{2}^{\circ}$, and that the axis of the earth always points in the same direction. The four dates chosen are June 21, December 21, March 21, September 23. Look in the table given to you and note the lengths of the days on these dates.

At midday on March 21 and September 23, an upright stick casts no shadow at the following places :—Quito,

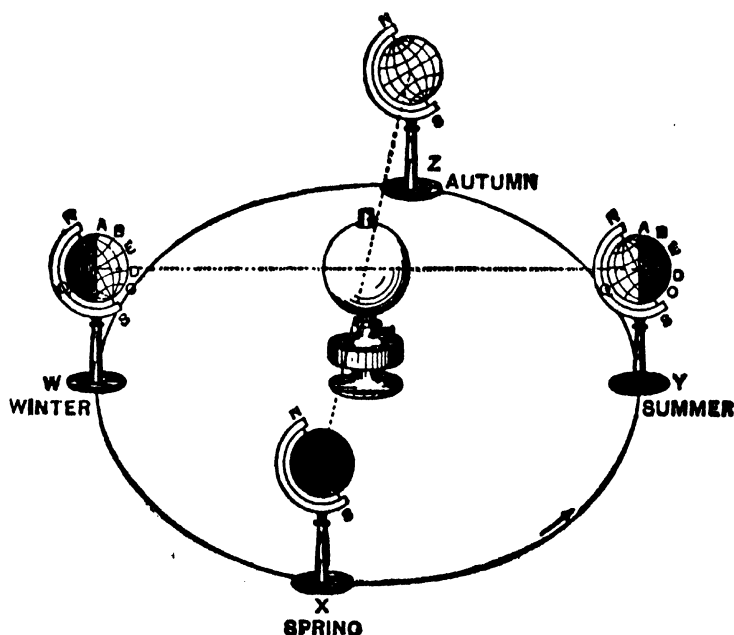


FIG. 15.—EXPERIMENTAL ILLUSTRATION OF THE CONSTANT DIRECTION OF THE EARTH'S AXIS, AND THE CAUSE OF SEASONS.

Gilbert Isles, Central Borneo, Victoria Nyanza and Cape Lopez. Find these places on a map or globe. On what line do they lie? If there are no shadows on that line at noon, the sun must be directly over the line at that time. Refer back to the previous figure. The sun's rays will be seen to reach from pole to pole on these dates. The following figure (Fig. 16) makes the matter still clearer. As the earth rotates, the part towards the sun is in the light and has day, and the part away from the sun is in the dark and has night. Consider a point on any one of the circles shown and you will see that the arc which it describes

in the sunlight (when the earth and sun are in this relative position) is equal to the arc which it describes in the dark.

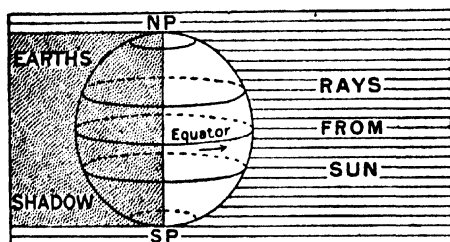


FIG. 16.—CONDITIONS OF EQUAL DAY AND NIGHT ALL OVER THE WORLD (MARCH 21 AND SEPTEMBER 22).

Thus on March 21 and September 23 all places on the earth's surface have their day and night equal. Each place has 12 hours day and 12 hours night. These dates have special names. We speak of March 21 as the **Vernal Equinox**, and of September 23 as the

Autumnal Equinox (*aequus*, equal; *nox*, night).

At midday on June 21 there are no shadows of upright objects at the following places:—Cape San Lucas (Lower California), Havana, the first Cataract of the Nile, Mandalay, Formosa. Find these places on a map or globe. They lie on a line called the **Tropic of Cancer**. What is its latitude? It is 1,600 miles north of the Equator. As there are no shadows on this line on June 21, the sun on that day must be perpendicular to the Tropic of Cancer. Refer back to Fig. 15 for a moment and then consider the larger diagram given here.

In this position the sun's light reaches beyond the North Pole but does not reach the South Pole. CD is the Equator, EF is the Tropic of Cancer, L may stand for London. Two other points A and B are marked. Consider each of these points in turn. In 24 hours the earth rotates once. The point A is never in the dark. At this place the sun does not set and there is no night. The arc described by L in the light is much longer than that which it describes in the dark. What

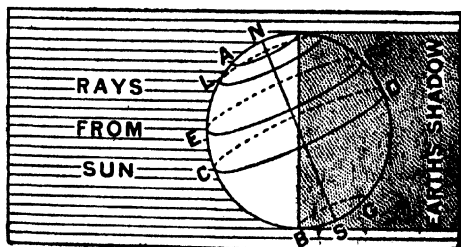


FIG. 17. — CONDITIONS OF LONGEST DAY IN NORTHERN HEMISPHERE (JUNE 21.)

is the length of the day in London on this date? of the night? The point C is on the Equator. The arc which it describes in the daylight is equal to that which it describes in the darkness, and day and night are of equal length. This is always the case at the Equator. The point B never gets into the light at all. At that place the sun never rises and there is one long night.

How many degrees are there from C to E? from C to N? from E to A? from A to N? from C to B? from B to S? If you cannot reason out the answers, copy the diagram and measure the angles with a protractor. The circle through C and D is the Equator; the circle through E and F (latitude N. $23\frac{1}{2}^{\circ}$) is the Tropic of Cancer and the circle through B and G (latitude $66\frac{1}{2}^{\circ}$ S) which marks the southern line of light, which is reached by the sun's rays at this time is called the **Antarctic Circle**. It is 4,800 miles south of the Equator.

At midday on December 21, there are no shadows of upright objects at the following places: — Antofagasta

(west of S. America), Oran, San Paulo (Brazil), Kalahari desert (South Africa), Southern Madagascar, Rockhampton (Queensland, Australia). All these places lie on a line called the **Tropic of Capricorn**, and as there are no shadows on this line at midday on December 21, the sun must be perpendicular to the Tropic of Capricorn at that time. The Tropic of Capricorn is 1,600 miles south of the Equator. What is its latitude? Refer back to Fig. 15 for a moment and look at the position of the earth on December 21 and then consult the figure given here, which is drawn on a larger scale. The letters are the same as in the last figure, but in this one the Tropic of Cancer has been omitted and the Tropic of Capricorn inserted. It passes through H and K. Notice that everything is now changed. A

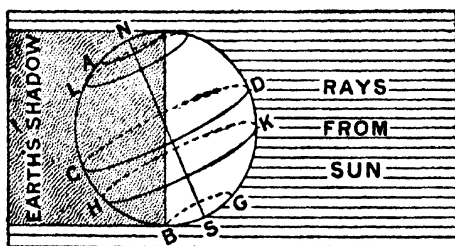


FIG. 18. — CONDITIONS OF SHORTEST DAY IN NORTHERN HEMISPHERE (DECEMBER 21.)

never gets into the light and has one long night, while B is always in the light and has one long day. London is in the light for a short time and in the dark for a long time. What is the length of the day and of the night in London on December 21? Points on the Equator still have 12 hours of day and 12 hours of night.

How many degrees are there from N to A? A to C? C to H? H to B? B to S? The northern line of light beyond which there is no day is the **Arctic Circle**. What is its latitude? It is 4,800 miles north of the Equator?

The times of sunrise and sunset at London for several days in June and December are here given.

Date.	Time of Sunrise.		Time of Sunset.	
	H.	M.	H.	M.
June 19	3	44	8	18
" 20	3	44	8	18
" 21	3	44	8	19
" 22	3	45	8	19
" 23	3	45	8	19
Dec. 19	8	4	3	50
" 20	8	4	3	50
" 21	8	5	3	51
" 22	8	6	3	51
" 23	8	6	3	52

Observe that for a few days near June 21, the sun rises and sets at about the same time, and that this also happens again for a few days near December 21. The days are of almost equal length and it appears as though the earth were standing still. The ancients thought that it was the sun that was really standing still and so they called June 21 the **Summer Solstice** (*sol*, sun; and *sto*, stand) and December 21 the **Winter Solstice**.

The word "tropic" means "turning line." When the sun has reached a point over the Tropic of Cancer it turns south until it reaches the Tropic of Capricorn, when it turns north again.

We can now explain how to find the latitude of a place on any day. As we have seen, on those days when the sun is over the Equator at noon, the angular altitude of the sun subtracted from 90° gives the latitude. But when the sun is north or south of the Equator the difference between the angular altitude and 90° does not give the latitude. When the sun is north of the Equator its noonday altitude is greater to us than when it is over the Equator, and we must subtract a certain number from the observed altitude before we can determine the latitude. When the sun is south of the Equator its noonday altitude is less to us than when it is over the Equator, and we must then add a certain number to the observed altitude

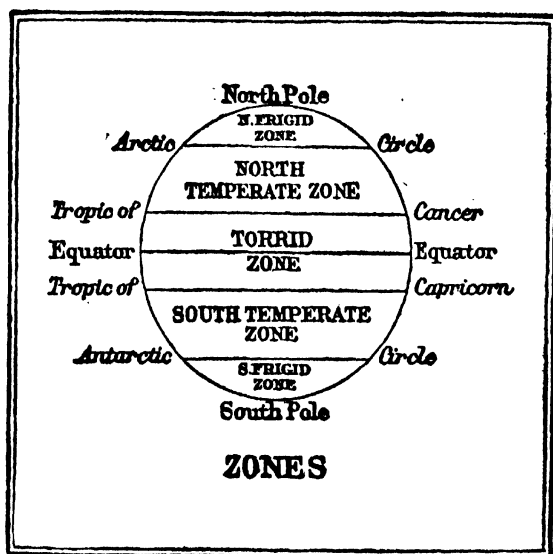


FIG. 19.—CLIMATIC ZONES.

before we can determine the latitude. The number to be added or subtracted varies from day to day. The displacement of the sun from the plane of the Equator is called its **Declination**. The Declination is 0° when the sun is over the Equator, and $23\frac{1}{2}^\circ$ when it is over one of the Tropics. The declination for each day is given in *Whitaker's Almanack*.

The belt of land between the two tropics is called the

Torrid Zone, or sometimes **The Tropics**. The sun is always perpendicular to some part of this zone. The belt of land between the Tropic of Cancer and the Arctic Circle is the **North Temperate Zone**, while that between the Tropic of Capricorn and the Antarctic Circle is the **South Temperate Zone**. The sun is never vertical to any place in either of the temperate zones, and the further we go from the Torrid Zone the colder it gets. The belt of land from the Arctic Circle to the North Pole is the **North Frigid Zone**, and that from the Antarctic Circle to the South Pole is the **South Frigid Zone**. Both the Frigid Zones have each one day of six months and one night of six months.

REVISION EXERCISES

1. How would you determine the correct position of a north and south line by observing the shadow of a stick cast by the sun ?

C. J., 1901.

2. Describe briefly the extent and importance of the cotton industry in England, explaining where the chief centres are, and what natural advantages they possess. Whence is the raw cotton obtained, and to what countries is it chiefly sent in its manufactured state ?

C. S., 1894.

3. On a map of South America trace the courses of the Amazon and the Parana. Insert the name of the strait separating Tierra del Fuego from the mainland. Insert also the Andes with the mountains Aconcagua, and Chimborazo, and the towns Buenos Ayres, Valparaiso, Rio and Lima. Mark the Gulf of Darien, Cape Gallinas, and Cape Horn. Draw a dotted line to represent the Tropic of Capricorn. Mark the Equator and number the meridians of longitude.

O. J., 1896.

4. Give a rough comparison of the lengths of the day (i.e., the number of hours the sun is above the horizon) on December 22 and June 21, at the following places : (a) Aberdeen (latitude 57° N) ; (b) Dunedin (latitude 46° S). Account for the differences observed.

O. S., 1899.

5. Describe any simple method by which you could determine approximately the latitude of the place you live in. What is the highest point above the horizon reached by the sun in latitude $57\frac{1}{2}^{\circ}$ at (a) midsummer, (b) midwinter ?

C. S., 1900.

CHAPTER V

SUNDIALS—SIDEREAL AND SOLAR DAYS

SUNDIALS are fairly common both in town and country districts. Some of them are very curious and you will find it an interesting amusement to photograph or get

photographs of all those in your own neighbourhood. The sundial is a very ancient instrument. It is said to have been used by the Hebrews over 700 years before the

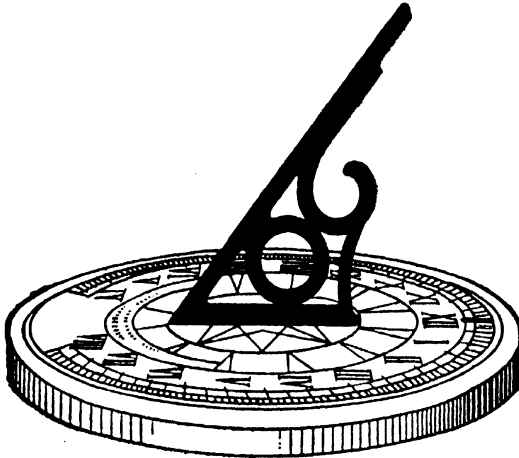


FIG. 20.—HORIZONTAL SUNDIAL.

birth of Christ, and the knowledge of its use and construction passed thence to the Greeks and so to the Romans.

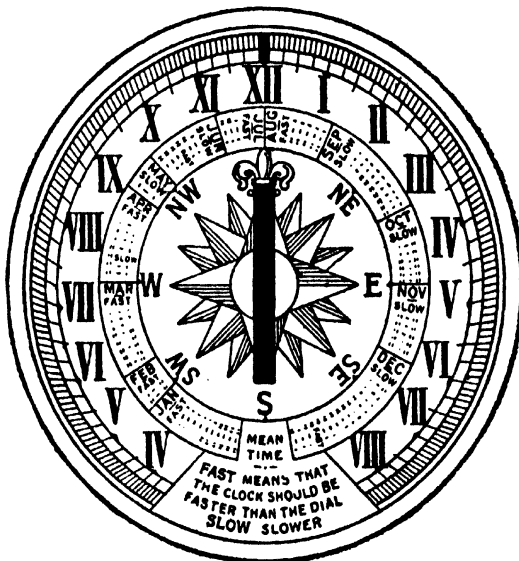


FIG. 21.—HORIZONTAL SUNDIAL FACE.

You can make a very simple sundial in the following way. Take a piece of stiff cardboard and on it describe a circle of any radius. Divide the circumference into twenty-four equal parts. Number the points i to xii, then i to xii again as shown (Fig. 21B). Run a hatpin through the centre of the circle, and by means of sealing wax, fasten it, on both sides, at right angles to the plane of the card. Obtain the true north and south line as in Chapter III. Turn the card so that xii noon is exactly over the north and south line. Slope the needle at an angle to the ground equal to the latitude of the place where you are going to



FIG. 21A.
VERTICAL SUNDIAL.

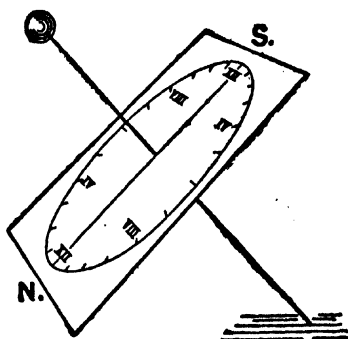


FIG. 21B.
A SIMPLE SUNDIAL.

put the dial. You can find the latitude of your town yourself, or from your atlas. The flat circle is the dial of the sundial; the hatpin is the stile or gnomon. It is much more convenient in practice to use a sundial which can be set permanently and securely in either a horizontal or a vertical position. The method of dividing such sundials is much more complicated than that given above.

Unfortunately, sundials, like sextants, are usually rather expensive articles to buy and fix on a building. The horizontal sundial shown in Fig. 21 is made in porcelain and is rather cheaper than one made of other materials.¹

By means of such a sundial, or failing this, by means of your toy one, keep a daily record as follows :—

¹ Such sundials as these can be obtained from Messrs. Newton & Co.

Date.	Sundial Time.	Watch Time.	Differences.	
			Sun fast.	Watch slow.

Get the correct time each day from the post office. The observations are of little value unless your watch is correct. You will find that on certain days in the year the sundial and the watch will practically agree. On every other day the watch will be either faster or slower than the dial. Note carefully the days when the two time-keepers agree and state to what parts of the earth's surface the sun's rays are perpendicular on those dates.

The time as given by the sundial we can call **apparent time**, or **sundial time**; that given by the watch or clock we can call **clock time**. When the sundial is slower than the clock we have to add a certain amount of time to the apparent time to make it agree with the clock time. On other days, when the sundial is faster than the clock we have to subtract something from the dial time to make it agree with clock time. The time which has to be added to or subtracted from the sundial time in order to make it equal to clock time is called the **Equation of Time**.

Plot a curve day by day from your own observations, giving the clock time when it is noon by the dial. Plot the dates horizontally and arrange the vertical spaces to read minutes from, say, 11.40 a.m. to 12.15 p.m. If on a given day the sundial says it is noon when your watch says it is 12.15, put a dot on the proper vertical line at 12.15. Join the points and notice the shape of the curve. From the chart you can find the amount of time to be added to, or subtracted from the dial time to make it agree with the clock time, that is, you can find the Equation of Time. Compare your results with those given in *Whitaker's Almanack*.

Suppose you go out on a clear night and note the position

of a certain bright star, just above, say, the chimney of your house. As the earth turns round on its axis, it turns away from the star so that the star appears to move across the heavens. Go out again the next night and note the moment when the same star is just over the same point of the chimney. The world has turned round once on its axis. The time of this complete rotation, as shown by

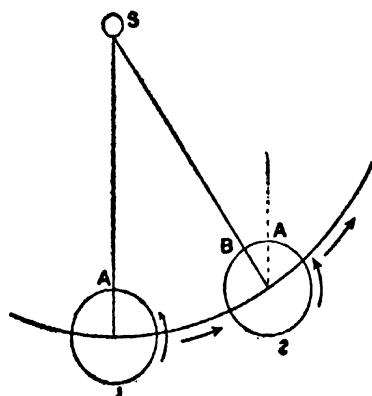


FIG. 22.—DIAGRAM TO ILLUSTRATE THE SOLAR DAY.

the star, is a "star-day" or a **sidereal day**, as it is usually called. The exact time of the rotation is 23 hours, 56 minutes, 4 seconds, as measured by the clock. Thus you see that it takes your meridian 23 hours, 56 minutes, 4 seconds to travel from a position opposite a certain star, right round through 360° and back again to the same position, opposite the same star again. The stars are so far away, that although we change our

position with regard to a particular one, it will appear to us to be in the same position on two successive evenings. But this is not so in the case of the sun, which is much nearer to us than the stars.

Look at Fig. 22 and imagine the earth in the position 1. A is a point opposite the sun. It is noon at A. As the earth rotates on its axis, it also moves along its orbit in the direction shown by the arrows. When it has made one complete rotation it is in the position numbered 2 and a sidereal day has been completed. But A is not yet opposite the sun. The earth will have to continue rotating until A reaches the position marked B, before it is again noon at the place we have called A. The length of time taken by the earth to make this extra turn is 3 minutes, 56 seconds, so that a solar day is 3 minutes, 56 seconds longer than a sidereal day.

The sundial gives you noon by the sun and so measures solar days. A solar day is the interval between two passages

of the sun across the same meridian. If we add together the lengths of all the solar days in a year and divide the total by the number of days in the year we get a **mean solar day**. Clocks and watches are so made that they keep mean solar time. The noon as given by the sun does not agree with the noon as given by the clock as you will find if you keep a record as explained above. As the clock days are all of the same length, it is evident that the sun days are not of all the same length. One reason for this is, that when the earth is in Perihelion (nearer the sun) it moves more quickly than when it is in Aphelion (further from the sun), so that the time of a rotation varies.

REVISION EXERCISES

1. What is meant by the latitude of a place? Why is it stated in degrees? How may it be determined? O. J., 1904.

2. The London Basin is surrounded by a wall of chalk, except on the east.

Draw a sketch map showing the position of this "wall." Name its chief divisions. Show the "gaps" traversed by the main lines of the Great Western, and London and North Western Railways.

O. S., 1906.

3. Draw a map of North America. Insert the Mississippi and its chief tributaries; Chicago, Montreal, New Orleans, New York, St. Louis, San Francisco, Vancouver, the Alleghany Mountains, and the names Cape Cod, Cape Breton Isle, the Yucatan Peninsula and the five great lakes. Also number the parallel 50° N. and the meridian 90° W. C. J., 1897.

4. Distinguish between the Earth's rotation and its revolution. Which of these causes the alternation of day and night and how?

C. J., 1895.

5. Explain why the days are longer in the North of Scotland than in the South of Ireland during summer, and shorter in winter. O. P., 1906.

CHAPTER VI

LONGITUDE AND TIME

WHEN any meridian is exactly opposite the sun, it is mid-day or noon at every place on that meridian. It is true noon to a man in London when the meridian passing through London is opposite the sun. It is noon to a man in New York when New York is opposite the sun. But as New York and London can never be opposite the sun at the same time, they can never have noon at the same time. When it is noon at one place it is midnight at a place exactly opposite on the other side of the globe. The earth rotates from west to east. Hence all places which are west of Greenwich will have noon later than Greenwich, while places east of Greenwich will have noon earlier than Greenwich.

Find from your atlas which of the following places have noon before or after Greenwich, and arrange them in two columns :—

Dublin.	Calcutta.	Quito.	Johannesburg.
Edinburgh.	Melbourne.	New York	Aden.
Paris.	Hong Kong.	Montreal.	Liverpool.
Berlin.	Limerick.	St. Louis.	Portsmouth.
Madrid.	Strassburg.	Lima.	Nottingham.
Rome.	Archangel.	Cape Town.	Bangkok.
Moscow.	Cambridge.	Bombay.	Yokohama.
Vienna.	Buenos Ayres.	Nagasaki.	

Find from your map or globe a number of important places that have their noon at the same time as—(a) London, (b) New York, (c) Calcutta, (d) Melbourne, (e) Cairo.

The world rotates upon its axis once in 24 hours. There are 360° in a circle. Therefore, the earth rotates 15° in one hour. If it takes 60 minutes for a place to travel 15° then it takes 4 minutes to travel 1°. A place 1° west of Greenwich will have to wait 4 minutes longer than Greenwich before it is noon at that place. Its clocks are 4 minutes slow by Greenwich time. If a place be 1° east of Greenwich it gets its noon 4 minutes before Greenwich, and its clocks will be 4 minutes fast by Greenwich time.

New York is 75° west of Greenwich. To travel 75° takes 5 hours. Therefore, when it is noon at Greenwich it is 7 a.m. in New York. Calcutta is 90° east of Greenwich. To travel 90° has taken 6 hours. Therefore, when it is noon at Greenwich it is 6 p.m. in Calcutta.

By consulting your map find sundial time in Newfoundland, Vancouver, Quito, Tierra del Fuego, North Cape, Ceylon, Brisbane, when it is noon at Greenwich.

What time is it in New York when it is 7 a.m. on Thursday in London ?

When it is noon in Greenwich what time is it in New Zealand ?

When it is noon at Greenwich, what time is it in Calcutta (nearly 90° E.), in New Orleans (90° W.) and in New Caledonia (165° E.) ?

C. J., 1894.

Plymouth is 4° west of Greenwich. It therefore has

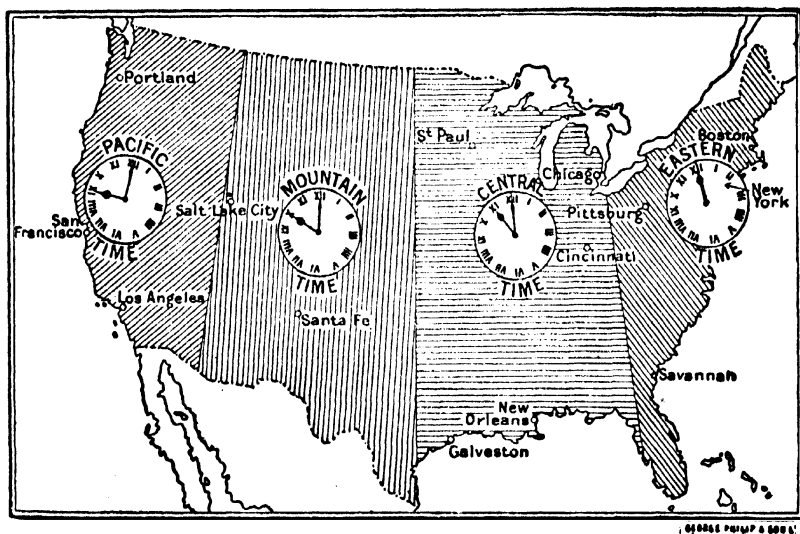


FIG. 23.—UNITED STATES, SHOWING TIME ZONES.

its noon 16 minutes later. Dover is 1° east of Greenwich ; therefore it has its noon 4 minutes earlier. But as it would be very awkward if every town in the country kept its own local time, it has been arranged that all towns in England shall keep Greenwich time. When it is noon at Greenwich, a telegraphic message is at once sent to many post offices and other places, and the clocks at these places are then set to mark 12 o'clock, if they do not already

do so. Other countries adopt similar arrangements. At all railway stations in France, **Paris time** is kept; at all Italian stations, **Roman time**. If you are on the frontier of France and Italy, you can often see two clocks, almost side by side, marking time with about 43 minutes difference between them. In North America, the question of clock time is a troublesome one, for there are about 45° difference in the latitudes of New York and San Francisco. It is noon in New York 3 hours earlier than at San Francisco. It would be foolish to make the clocks at the two places mark the same noon. The real differences are too great. The United States, for clock times, is divided as shown in figure 23, and different standard times are recognized. Each different time is employed over a breadth of 15° of longitude.

When the captain of a vessel goes to sea, he takes with him a very accurate clock called a **chronometer**. This chronometer keeps Greenwich time. Suppose that the vessel is sailing between Liverpool and New York. On a given day the captain notices that the sun is at its highest point in the heavens, that is, that it is noon on his meridian, at a time when the chronometer says that it is 2 p.m. at Greenwich. Comparing the time given by the sun, and that given by the chronometer, he is two hours slow. He knows that in 1 hour the world travels through 15° , and therefore in 2 hours it travels 30° . He must be 30° from Greenwich. As his time is *slower* than that of Greenwich he is to the west. He is in longitude 30° W.

REVISION EXERCISES

1. What is meant by longitude? How is it determined?
C. S., 1901.
2. Point out the advantages to trade of the making of the Kiel Canal, the Caledonian Canal, the St. Gotthard Tunnel, the Severn Tunnel.
O. J., 1901.
3. On a map of North America insert the St. Lawrence and its lakes, the Mississippi and Missouri; Rocky Mountains, Bering Strait, Vancouver Island, Cape Farewell, Florida, Alaska, British Honduras, San Francisco, Quebec, Boston, New Orleans, Chicago.
O. J., 1898.
4. A sea-fight is said to have occurred in a certain latitude N. and longitude W. Explain clearly how the information thus given fixes

the spot. Give the latitude of (a) the Tropic of Capricorn, (b) the North Pole. If I travel due west from Greenwich, until I have gone half way round the world, in which longitude shall I be?

C. J., 1893.

5. Explain the use of a chronometer in determining longitudes. Describe the apparent courses of the sun throughout a midsummer day to an observer (a) at Quito, (b) at the North Pole.

C. S. 1895.

CHAPTER VII

THE REVOLUTION OF THE EARTH. THE FOUR SEASONS

THE earth, travelling in its elliptical orbit, makes one revolution round the sun in about 365 days, and this period, which is the time taken to make one complete revolution round the sun, we call a **year**. The distance travelled by the earth in a year is about 583,825,756 miles. About how many miles per hour does it travel?

We have seen how the inclination of the axis of the earth causes the day and night to be of different lengths at different times of the year. This inclination of the earth's axis is also the cause of the four **seasons**, Spring, Summer, Autumn, Winter.

When the sun is perpendicular to the Tropic of Cancer, our days are long and our nights are short. At that time we have sunshine for many hours and darkness for a few. We keep in front of the fire, as it were, for many hours, while we are only shut out in the cold for quite a short time. The weather at this time is warm and we are having **summer**. When the sun is perpendicular to the Tropic of Capricorn, our days are short and our nights are long. At that time, the people on the other side of the world, in Australia and New Zealand, get most of the fire and we are shut out for hours in the cold and the dark. We are having **winter**.

When the sun is perpendicular to the Tropic of Cancer, it is high in the sky, and its rays fall upon us at a certain

angle. But six months later, when its rays are perpendicular to the Tropic of Capricorn, we see the sun low down in our sky, and its rays fall upon us in a much more slanting direction than they did before.

The difference between the angle at which the sun's rays fall upon us in June and the angle at which they fall upon us in December partly accounts for the fact that we have summer in June and winter in December. Toast two pieces of bread in front of the fire. In the first case, hold the piece of bread parallel to the bars of the grate, so that the rays of heat fall perpendicularly on the bread. In the second case hold the piece of bread slanting towards the bars so that the rays of heat fall at an angle upon the bread. The first piece will be toasted much sooner than the second. This is merely a simple experimental proof of a well known fact, that more heat is received from a hot body when its rays fall directly upon the object to be warmed than when they fall upon it in a slanting direction. Hence, when the sun is perpendicular to the Tropic of Cancer, not only do we get more sunshine than we do when it is over the Tropic of Capricorn, but we also get the rays more directly in the first case than the second.

Again, when the sun is over the Tropic of Cancer, the rays have to travel through a certain thickness of air before they reach us. When the sun is over the Tropic of Capricorn the rays have to travel through a much greater thickness of air before they reach us. The air, and the moisture in the air, absorb a certain amount of heat. The greater the thickness of air through which the sun's rays have to pass the more are we robbed of the heat contained in those rays.

The Year. As we have a sidereal day, so we have a sidereal year. This is the interval between the time when the sun and a particular star are on the same meridian and the time when they are again on the same meridian. The length of this year is 365 days, 6 hours, 9 minutes, 9 seconds.

The sidereal year, like the sidereal day, is not the one used in ordinary life. The year upon which the calendar is based, is the interval between the moment when the sun is over the Equator and the moment when

it again returns to the same position. To express it in another way, it is the interval between two returns of the sun to the vernal equinox. This kind of year is called a **Tropical Year** or an **Equinoctial Year**. Its length is not 365 days, as given by the calendar, but 365 days, 5 hours, 48 minutes, 50 seconds. If we went on year after year, calling the length of the year 365 days, we should find, that in time, these odd hours had so accumulated, that what we call summer would not fall in June as it does now. The seasons, in fact, would not agree with the annual changes of temperature.

Now, 5 hours, 48 minutes, 50 seconds is very nearly 6 hours, that is, nearly a quarter of a day. In four years they amount to nearly a whole day. Thus in four years we should get to the time of the vernal equinox one day too soon, and the vernal equinox would occur on March 20 instead of on March 21. Four years later the sun would be over the Equator on March 19 instead of March 21, and so on. To avoid this, Julius Caesar (B.C. 45) ordered that every fourth year, there should be an extra day in February, giving us 29 days for that month instead of 28 days. At such times the year contains 366 days instead of 365 days, and is called a **leap year**.

But observe that 5 hours, 48 minutes, 50 seconds, is not exactly 6 hours, so that though we have a leap year every four years, yet still the average year, according to the calendar, is too long. Every year the sun arrives at the vernal equinox a few seconds too soon. In 1582, the sun was over the Equator on March 11, instead of on March 21. So Pope Gregory ordered that 10 days should be dropped out of the year to put this right, and in 1582, the next day after October 4, was called October 15, whereat many ignorant and foolish people made a great disturbance, because they thought that the Pope was thereby shortening their lives.

The Pope also ordered that in future, when the fourth year terminated a century, it should only be counted a leap year when it could be exactly divided by 400. Thus 1600 and 2000 are leap years, but 1700, 1800 and 1900 are counted as ordinary years.

The Gregorian Calendar or New Style was soon adopted by all the Catholic countries of Europe, but England clung to the Old Style till 1752, when the New Style was adopted.

REVISION EXERCISES

1. Explain fully the meaning of (i) the plane of the ecliptic; (ii) the Arctic circle; (iii) the Equinoxes; (iv) the Tropic of Capricorn.

C. J., 1905.

2. How is it that the steel-making industry has come to be much concentrated in and about South Wales?

Name the special form of industry carried on in each of the chief towns in Great Britain where steel is either made or is worked up into manufactured goods.

Name the chief towns connected with the manufacture of steel goods in France, Germany and Russia respectively.

C. S., 1893.

3. Draw a sketch map of South America showing the States and their capitals.

C. J., 1898.

4. What causes determine the succession of the seasons, viz., Winter, Spring, Summer and Autumn in our latitude?

O. J., 1896.

5. Explain why, as a general rule, the temperature decreases as we go from the tropics to the poles.

C. J., 1898.

CHAPTER VIII

THE SEA

WE can walk about on the land and examine it by looking at it. But we cannot see the land under the sea, and so we must examine it in another way. We want to know three things: (i) how deep the sea is in different places; (ii) what its bed is like; (iii) what is the temperature of the water at different depths.

To find how deep the sea is, a **sounding line** or a **sounding rod** is used. The first is merely a rope with a weight at the end. The rope is marked in fathoms by pieces of coloured worsted, and a different colour is used to mark every 10 fathoms. A sailor lowers the rope from his vessel, and when the lead touches the bottom he reads the number of fathoms. This instrument is only used near the coastline, when the sailor wants to know the depth of comparatively shallow water. If the sea is more than 100 fathoms deep, the ship is in safe water, but if the depth is less than 100 fathoms, then the ship is nearing land, and if there is fog, the ship must go slowly and carefully. Consider the following diagram:—A represents the visible land at the edge of a continent. B shows where

the sea begins. For a certain distance from the coast, there is usually shallow water, and the submerged land beneath is called the **Continental Shelf**. Over the shelf the water is at least 100 fathoms deep. At C, beyond the shelf, the depth is very much greater. Hence, whenever the depth of water is greater than 100 fathoms, the sailor is not over the continental shelf; he is over the "deep, deep sea," and therefore, in safe water.

The continental shelf is wide in some parts of the world and narrow in others. It is very wide in the north-west of Europe. The British Isles stand on the shelf, so that

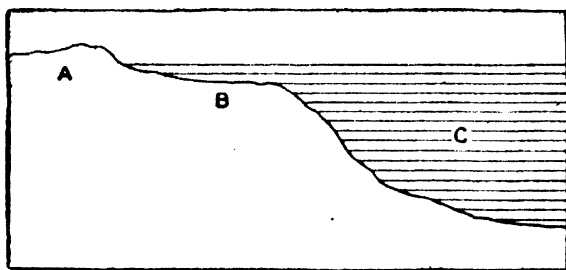


FIG. 24.—DIAGRAM ILLUSTRATING THE CONTINENTAL SHELF.

the North and Irish Seas surrounding them are very shallow. If you sailed west from Ireland, sounding as you went, you would find that the bed of the Atlantic would slope only about 6 ft. in a mile until you got 230 miles from shore, and then it would sink 9,000 ft. in the next twenty miles. The continental shelf unites Borneo, Java and Sumatra to South-eastern Asia, and New Guinea to Australia. The Falkland Islands, off South America, are united to the continent, under the water, in this way.

Examine a physical map of each of the continents, and note the variation of the width of the continental shelf.

The greatest depths in the ocean floor are about as much below sea level as the highest points on the land are above it. If the surface of the sea could be lowered about 10,000 ft., half the world would be land and half would be water. At present only one quarter of the surface of the earth is land, the other three-quarters being water. Where the water is more than 10,000 ft. deep, we have what is called

the **Abysmal area**. Where it is less than 10,000 ft. deep we have the **Transitional area**. Until 1872 very little was known about the abysmal area, but from 1872-76 a British man-of-war, the *Challenger*, made a journey round the world, sounding the depths of the ocean and exploring the ocean bed. The sounding apparatus used by the members of the *Challenger* expedition was not a line like the one we have described, but a steel pianoforte wire, which had been coated with zinc to prevent it rusting (Fig. 25). It had a number of weights on the lower end, each weighing



FIG. 25.—DEEP
SEA SOUNDING
APPARATUS.

about 1 cwt. It was so made that when the weights touched the bottom of the ocean, they were thrown off. There was also a tube, provided with a valve that opened inwards. When the weights struck the bottom, the tube descended into the mud and the valve was pressed upwards. When the sounding rod was drawn up again, the valve was pressed downwards and the contents of the tube were thus prevented from escaping. To the rod there was also attached a self-registering thermometer, similar in principle to the maximum and minimum thermometers you are already acquainted with, but differently constructed. Thus, when the rod was pulled up three things were known about the sea at that point: (i) its depth; (ii) its temperature; (iii) the character of the ocean bed. Sometimes more than 5 miles of wire were wanted, but the average depth of the abysmal region was about 3 miles.

Take a blank map of the world, or preferably a series of blank maps, showing the different oceans and insert the names given below, as you study the matter.

The Atlantic Ocean. Mark on a blank map the Arctic Circle, the west coasts of Europe, Africa, and the east coasts of North and South America. The lines you have drawn mark the north, east and west boundaries

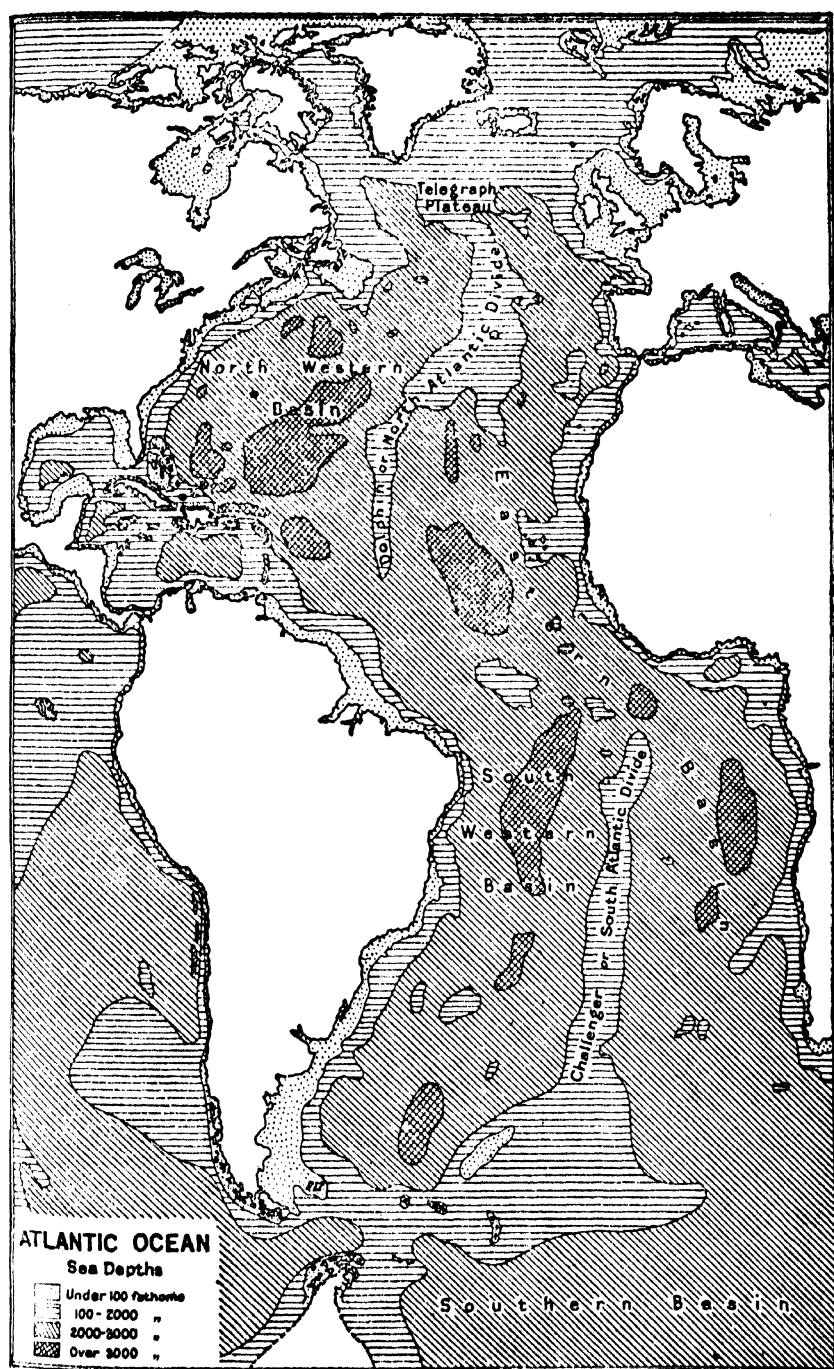


FIG. 26.—ATLANTIC OCEAN, SHOWING DEPTHS.

of the best known of all the oceans. Name from your map the countries whose shores are washed by this ocean. Notice that if it were possible to move America until it met Europe and Africa, their coastlines would

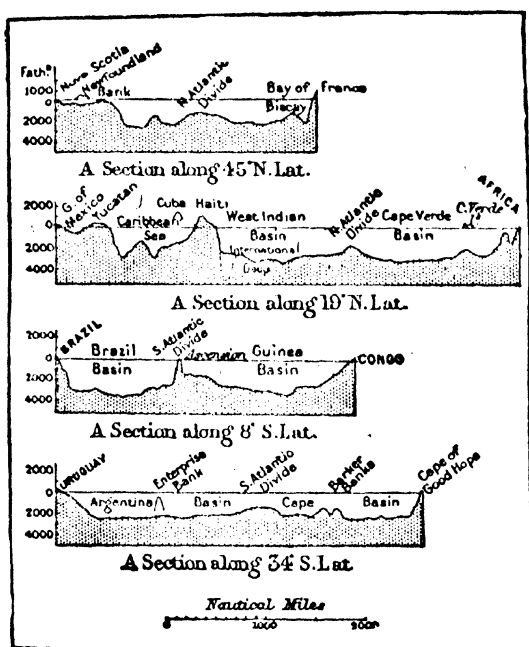


FIG. 27.—SECTIONS ACROSS THE ATLANTIC OCEAN.

approximately fit into each other. Into what opening would Newfoundland go? Northern Africa? Brazil? The opposite coasts of the Atlantic are therefore roughly parallel.

What is the distance between :—Greenland and Norway, Florida and Morocco, Rio de Janeiro and Cape Town? At what point does the Atlantic Ocean meet the Indian Ocean? the Pacific Ocean?

Find Cape Farewell (Greenland) and the Island of Tristan d'Acunha. Join these by a line drawn roughly parallel to the east and west coasts of the Atlantic, and midway between them. The line marks approximately the position of a great ridge which stands up from the bed of the ocean. Deeper water near the Equator separates the ridge into two parts: (i) a northern, called the Dolphin, or North

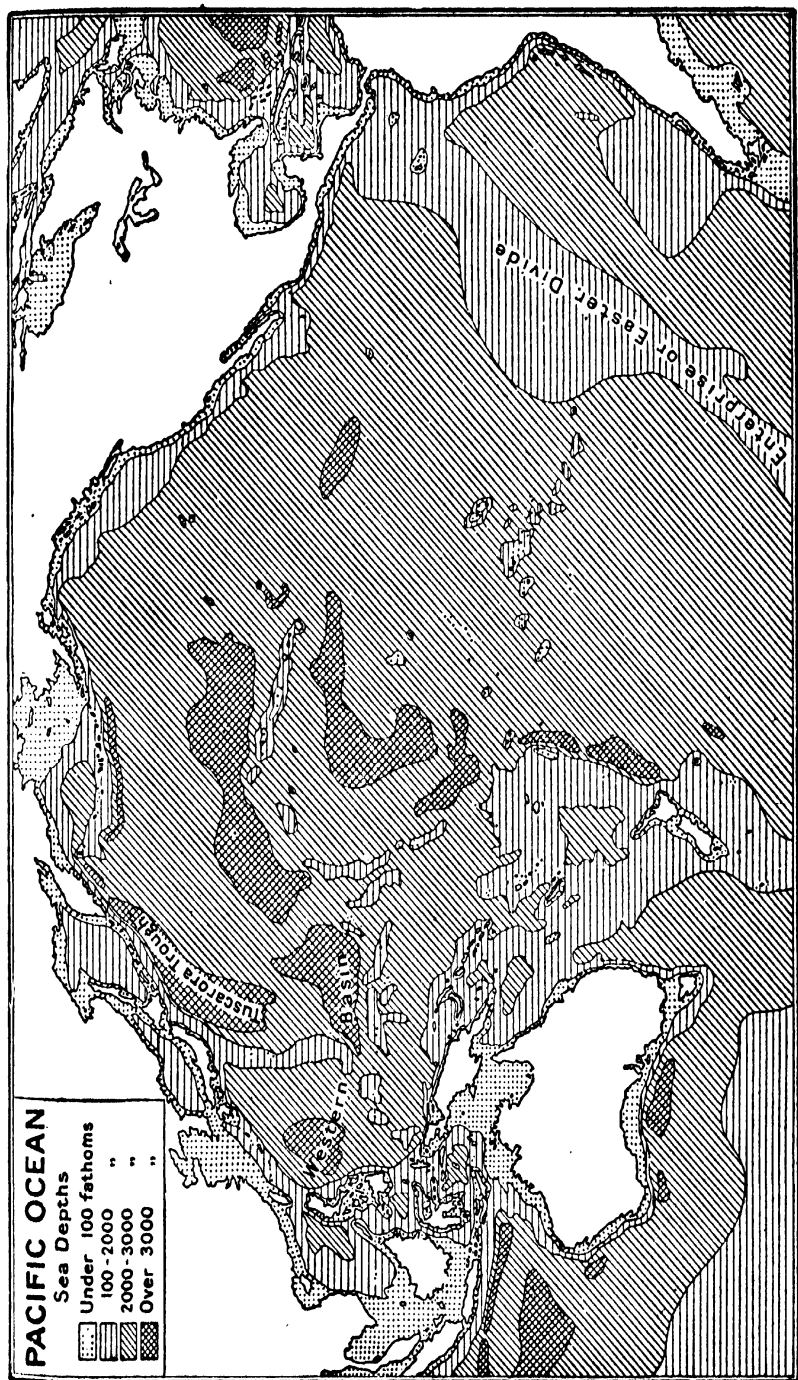


FIG. 28.—PACIFIC OCEAN, SHOWING DEPTHS.

Atlantic Divide; and (ii) a southern, called the Challenger or South Atlantic Divide. The divide broadens out in different parts, forming a number of plateaus. The plateau between Ireland and Newfoundland is the one along which the Atlantic cables are laid, and is known as the **Telegraph Plateau**. On either side of the central divide lie deep basins. Mark the names of these on your map.

(i) **The Eastern Basin** lies between the central divide and the coasts of Europe and Africa. It extends from Ireland to the Cape, and has an average depth of 2,500 fathoms.

(ii) **The North-western Basin** lies between the central divide and the coast of North America. It extends from Newfoundland to Trinidad, and has an average depth of 3,000 fathoms. The deepest spot (4,561 fathoms) in any part of the Atlantic Ocean is found in this basin, about 80 miles north of the island of St. Thomas, and is known as the International Deep.

(iii) **The South-western Basin** lies between the central divide and the coast of South America, and has an average depth of 2,500 fathoms. The deepest part of this basin is between the islands of Ascension and Trinidad.

(iv) **The Southern Basin** extends south of the Cape and the Falkland Islands.

Find on your map the places shown in Fig. 27, and try to imagine to yourself from the sections there given what the floor of the Atlantic would look like in different parts, if all the water could be pumped out. Mark on your own map the Baltic Sea, North Sea, Mediterranean Sea, Hudson Bay, Gulf of Mexico, Caribbean Sea.

Islands like the Azores, Ascension Island, etc., which never were connected with a continent are called **oceanic islands**, while islands like Great Britain, Newfoundland, etc., which stand on the continental shelf, and which have been separated from the continent by the sinking of the land or the action of the sea are called **continental islands**.

The Pacific Ocean. The boundary line of this ocean runs from the middle of Bass Strait, round the east and north coasts of Australia. It is then bounded by Timor, Java, Sumatra, and the east coast of Asia. Its

eastern boundary is formed by the coasts of North and South America. Bering Strait forms its northern boundary. Mark the Antarctic Circle. This shuts it off from the Antarctic Ocean.

The average depth of the Pacific Ocean is greater than that of the Atlantic. The deepest sounding yet obtained with trustworthy instruments is in the "Nero Deep," N. lat. $12^{\circ} 40'$, E. long. $145^{\circ} 40'$, where a depth of 5,269 fathoms (31,614 feet) was reached. Mark this point on a map of the Pacific Ocean. Two other soundings, obtained to the north of New Zealand, were each over 5,000 fathoms.

The basin of the Pacific possesses no great Central Divide like that of the Atlantic Ocean; on the contrary a series of deep depressions occupy the centre of the Ocean, of which the **Tonga** and **Kermadec Troughs** (east of the Tonga and Kermadec Isles respectively) are the most important. West of these lie the comparatively shallow waters off the Australian coast, and to the East, the **Enterprise or Eastern Divide**, stretching from the Antarctic Ocean to the Gulf of Panama, forms the western boundary of the deep basin lying off the Pacific coast of South America. The **Central Basin**, out of which rise the Sandwich Isles and other isolated island groups, occupies the northern parts of the ocean, and reaches its greatest depth in the **Tuscarora Deep** off the coast of Japan. The Central Basin has a greater average depth than any other portion of the Pacific. The **Western Basin** lies between the coast of Asia, south of Japan, and the islands situated off the east coast of that continent. It consists, for the most part, of shallow and nearly land-locked seas; but between the Caroline and Ladrone Islands the average depth is 3,000 fathoms. This depression, which reaches its greatest depth in the **Nero Deep**, is known as the **Ladrone Basin**.

Mark on your blank map the divisions of the Pacific Ocean mentioned above, and also the following:—Bering Sea, Sea of Okhotsk, Sea of Japan, Yellow Sea, China Sea, the Gulf of California, and the Gulf of Panama.

The Indian Ocean. The southern boundary is the parallel of latitude 40° S. The other boundaries are the east coast of Africa, the south of Asia, the Sunda Islands, and the

west of Australia. Name the important countries washed by the Indian Ocean. Mark on your map the position of the Red Sea, Arabian Sea, Persian Gulf, Bay of Bengal.

In the Indian Ocean the **Indian Dividing Ridge**, extending from India to the Antarctic Ocean, corresponds to the great central divide in the Atlantic. The deepest part of the ocean is between Java and the north-west of Australia, the greatest known depth (3,393 fathoms) being found in the **Recorder Deep**, south east of Java.

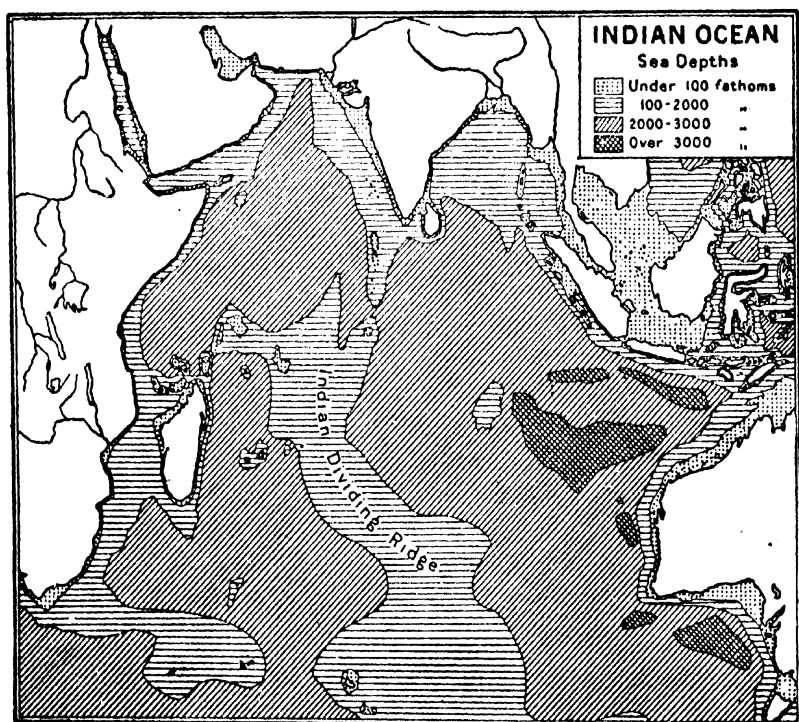


FIG. 29.—INDIAN OCEAN, SHOWING DEPTHS.

The Arctic Ocean was at one time supposed to be comparatively shallow, but Dr. Nansen found that in parts of the ocean beyond 79° N. the sea suddenly sank from a depth of about 100 fathoms to depths of 1,800 to 2,000 fathoms. It thus appears that the north polar basin is fairly deep. It is cut off from the basin of the Atlantic Ocean by a submarine ridge, which extends from the Shetlands to the Faroe Islands and Iceland.

The Antarctic Ocean is less known than the Arctic Ocean, as it has been less frequently visited by explorers. In 1841 Sir James Ross explored the waters lying to the east of Victoria Land, and found that they were comparatively shallow, nowhere exceeding 500 fathoms in depth. It is probable that the average depth of the Antarctic Ocean is under 1,500 fathoms. These southern waters were explored in 1903 by Captain Scott, and last year (1907) another South Polar Expedition set out under the command of Lieutenant Shackleton.

Composition of Sea Water. Every hundred pounds of sea water contains on an average $3\frac{1}{2}$ lb. of solid matter, the chief constituent of which is common salt (sodium chloride). The nasty bitter taste of sea water is due to a small quantity of Epsom salts (magnesium chloride). In places like the Baltic Sea, where there is much fresh water and little evaporation the proportion of salt is less than that given above. In seas like the Red Sea, where there is no fresh water supply and much evaporation, the proportion of salt is twice as great as in the Baltic Sea. In the polar seas, where there is much ice and little evaporation, the proportion of salt is small. Again, near the mouth of a large river, there is a small proportion of salt. Fresh water being lighter, bulk for bulk, than salt water, it happens that sometimes the fresh water from a great river, on entering the sea, will flow as a kind of current at the surface of the ocean, for quite a long distance, before mingling with the salt water.

Temperature of Sea Water. The temperature of the surface water of the ocean varies very considerably. At the poles it is often as low as 28° F., while at the tropics it is often as high as 95° F. The depth of warm surface water is, however, nowhere very great, and the water near the bed of the ocean is nearly at freezing point even in the tropics. The temperature of the sea at any given point changes but very little. The difference in temperature between the hottest hour of the day and the coldest hour of the night is not greater than one degree.

Marine Deposits. The members of the *Challenger* expedition made a very careful examination of the material

which they collected from different parts of the bed of the ocean. Since their time many other investigations of this kind have been carried out, and we have now a fair knowledge of the substances that lie deep down below the surface of the sea. The materials found may be divided into two great classes.

(i) Deposits formed near the land (Terrigenous Deposits). These consist of stones, sand and mud brought down by the rivers or washed away from the cliffs. One of the commonest deposits is Blue Mud, which is found round the shores of most countries and in most inland seas. There are also deposits of Red Mud and Green Mud, the colours of which are due to the presence of certain minerals. Where there are volcanoes or volcanic islands, we have Volcanic Mud, formed by the decay of the various volcanic products. In the neighbourhood of coral islands, we have Coral Mud.

(ii) Deposits formed in deep water, away from the land (Pelagic Deposits). Far from the land, both at the surface and in the great depths, there are many small animal and vegetable forms, some of which possess hard skeletons of lime or silica. When the little creatures die their bodies fall to the bottom of the sea, and collect there. In the course of centuries, they have formed layers on the bed of the ocean. Such deposits are called **oozes**.

The "oozes" are either (a) Calcareous, or (b) Siliceous.

(a) Calcareous oozes are chiefly formed of the remains of certain microscopic animals that secrete a shell of carbonate of lime. They are known as the **Foraminifera**. One genus forms the greater part of the **Globigerina ooze**. This ooze is most widely distributed over the bed of the North Atlantic. It is also found in the shallower parts of the Pacific, in the neighbourhood of North Australia and of New Guinea, and in other parts.

(b) Siliceous oozes consist of the remains of organisms whose skeletons are of silica. They are found most widely in the Pacific and Antarctic Oceans. Amongst the organisms which form these oozes the chief are certain minute animals called **Radiolaria**, and certain unicellular plants called **Diatoms**. The Diatoms are particularly abundant on the floor of the Arctic Ocean.

Below 2,000 fathoms there are no chalky oozes, for chalk is slightly soluble in sea water, and before the remains can reach the great depths they get dissolved. Oozes formed of silica occur everywhere, for silica is insoluble in water. At very great depths, however, siliceous remains are not usually very abundant.

The floor of the abysmal region is covered with red clay, composed of decayed pumice stone. It collects very slowly, as can be seen from the fact that the ear bones of species of whales that have long been extinct still lie uncovered upon its surface.

REVISION EXERCISES

1. Describe two deep-sea deposits which are being formed by the remains of animals and plants. C. J., 1905.

2. Describe accurately the position of the Forth and Menai bridges, and of the Mont Cenis, St. Gotthard and Severn tunnels. Show the special importance of each as it affects facilities for communication.

C. S., 1890.

3. On a map of South America, draw the boundaries of British Guiana, and insert the Gulf of Darien, the Straits of Magellan, the Orinoco, the Amazon, with its tributary the Madeira, the Parana, and the Paraguay; Cape St. Roque, Santiago, Buenos Ayres, Georgetown, Pernambuco, Quito. Mark the Equator and number the lines of latitude and longitude.

O. J., 1900.

4. Explain the meaning of the term "continental shelf." Draw a map of the coast lines of western Europe and Greenland, and show the course and extent of the continental shelf in this region.

O. J., 1897.

5. Draw an outline map of the North Atlantic Ocean and mark upon it the contour lines of 1,000, and 2,000 fathoms. Shade the areas which have a still greater depth and mark upon your map the position of the Azores.

O. J., 1889.

CHAPTER IX

WINDS AND CURRENTS

IN Part I we have already explained how winds arise; viz., by the flowing of air from regions of high pressure, to those of low pressure, and how land and sea breezes are formed. If you have forgotten these points, turn back to the earlier chapters, and revise the matter. It is con-

venient now, in connexion with the great oceans, to consider the subject of winds a little more fully.

Trade Winds. In the tropics the sun is always vertical to some place or other at noon. Its rays are then very hot, and both land and sea get heated. The air rises and cold air presses in from north and south. Suppose the earth to be at rest, and its surface consisting entirely of land, or else of sea. Then one constant wind would come from the north and another would come from the south. But the earth is not at rest. It is turning from west to east. All parts do not turn at the same rate. A place on the Equator moves at about 1,000 miles an hour, but the rate of rotation decreases gradually towards the poles. The cold air coming from the North to the Equator is drawn from a region where the earth is moving more slowly towards the east than it is at the Equator. The wind therefore lags behind and it appears to come from the north-east. In the same way the cold currents from the south appear to blow from the south-east. These constant winds are called the **North-East Trade Winds** and the **South-East Trade Winds**. Draw a circle of 6-in. radius. Mark the Equator. Mark the parallels of latitude 9° N., 28° N., 6° S., 25° S. The north-east trade winds blow between the two northern lines and the south-east trades between the two southern lines. Mark their direction with arrows.

We have spoken about the cool currents that flow towards the Equator from higher latitudes. What about the hot air that ascends from the Equator? This air divides into two streams, one flowing north and the other south. They leave parts of the world which are travelling quickly to go to parts that are travelling more slowly, and they appear to come from the west. They are called **anti-trade winds**, or sometimes the **return trade winds**, and they blow north-west and south-west. As they go polewards they get cooled, and descend to the earth at about latitude 30° . Mark the two parallels, 30° N. and 30° S., and the two 60° N. and 60° S. The anti-trade winds blow in these areas. Between 40° S. and 50° S. in the Pacific and South Indian Ocean they are called the **Roaring Forties**.

A belt of calms, called by sailors the **Doldrums**, exists where the North-East and South-East Trade Winds meet ; for though these winds combine to form an easterly wind, its influence is entirely neutralized by the strong current of hot air which rises from the Torrid Zone. The width of this belt of calms is about 6° or 7° , and it follows the sun in its passage north and south of the Equator. The heat is almost suffocating, and is accompanied with a heavy rainfall and almost daily violent thunderstorms. There are also calm belts at the Tropics of Cancer and Capricorn.

Monsoons blow in the Indian Ocean, the Gulf of Mexico, Brazil, Chile and in the seas between China and Australia. As they affect the climate of India to a very considerable degree we shall leave them till we consider the climate of Asia.

Ocean Currents. The waters of the ocean are never still. They are subject to several movements, of which the chief are *tides*, *waves* and *currents*. The last named are produced in several ways.

(i) Winds, when they blow steadily in one direction, give the surface water a steady drift or current.



(ii) The water at the Equator being warmer than that at the Poles, is lighter bulk for bulk than that at the Poles, and flows towards them, while the cold water from these Arctic regions flows underneath, towards the Equator, to restore the balance.

(iii) So much water evaporates at the Equator, that currents of water must flow in from the Poles to restore the balance.

The **direction** of the currents is partly due to the earth's rotation on its own axis.

Currents of the Atlantic Ocean. The North-East and South-East Trade Winds set up parallel equatorial currents with a westward flow. Were these currents not deflected by continental land-masses, they would flow right round the globe. The southern and stronger arm of this **Equatorial Current** flows from Ascension and the Equator to Cape St. Roque, while the northern and feebler arm flows from between the Tropic of Cancer and 10° south

OCEAN CURRENTS

 Warm Currents
 Cold Currents
 The arrows show the direction of the currents

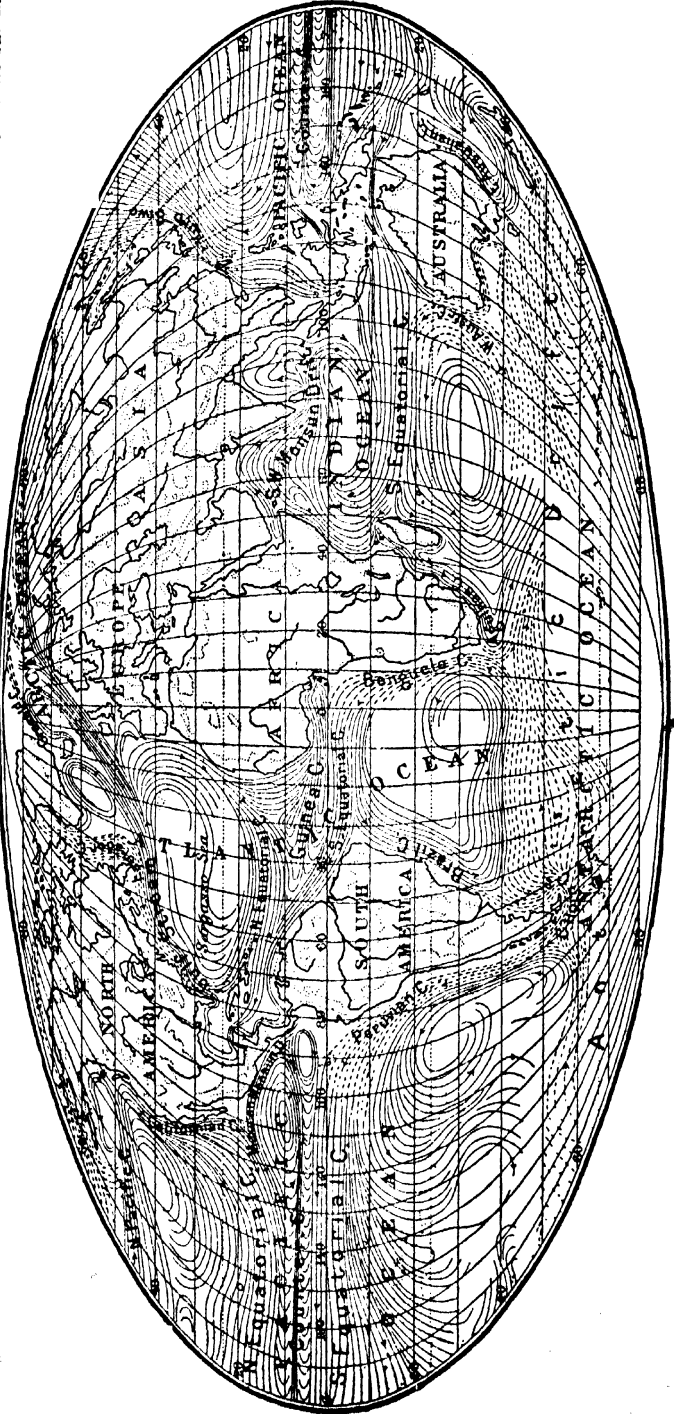


FIG. 30.—THE WORLD, SHOWING OCEAN CURRENTS.

latitude to the Antilles. In between these two arms and some degrees north of the Equator, the **Guinea Current** flows in an easterly direction, reaching the coast of Africa near Sierra Leone, and attaining off Cape Palmyras a velocity of 100 miles in the 24 hours. The Southern Equatorial Current divides opposite Cape St. Roque, one branch, known as the **Brazilian Current**, flowing south-west along the coast of South America as far as the estuary of the Rio de la Plata. From about 25° south latitude the westerly winds begin to deflect part of this current eastwards; it recrosses the Atlantic as the **Southern Connecting Current**, and joins, about the latitude of Cape Town, the cold northerly drift of the **Benguela Current**. From Cape St. Roque the northerly branch of the South Equatorial Current flows with increasing velocity along the coast of Guiana, and unites with the North Equatorial Current east of the West Indies. Here the current divides: one part enters the Caribbean Sea and passes through the Strait of Yucatan. In the Gulf of Mexico its movement is scarcely perceptible; but at the entrance to Florida Strait its velocity increases, and it passes through the Strait, under the name of the Florida Current or **Gulf Stream**, with a surface movement of nearly 5 miles an hour. The other portion of the Equatorial Current flows "outside" or north of the Lesser Antilles and Bahamas, and, carrying a vast volume of heated water, rejoins the Gulf Stream off the coast of Florida. Thence the blue and warm waters of the Gulf Stream flow north-eastwards, separated from the American coast by the "**Cold Wall**," a current of cold water issuing from the Gulf of St. Lawrence. As the Gulf Stream expands in width, it loses in warmth and velocity, till about half-way between America and Europe (in 40° west longitude) it ceases to be recognizable as a current, though owing to the prevalent westerly winds it passes over into a *drift*, spreading out its branches fan-wise over the North Atlantic, and exercising a warming influence on the climate as far north as the coasts of Norway and Spitzbergen. Of the numerous branches into which this **Gulf-Stream Drift** splits up, the southernmost bends round the Azores and

the West African coast, and ultimately rejoins the North Equatorial Current. Other branches reach the coast of Spain and Bay of Biscay, and the principal arm passes the shores of the British Isles and Norway, and exerts a warming influence even in the Arctic Ocean.

A current of cold water flows from the Polar Sea southwards along the east coast of Greenland and rounding Cape Farewell, flows up its west coast. A second cold stream—the Labrador Current—flows out of Davis Strait, along the coasts of Labrador and Newfoundland; and striking the Gulf Stream, sinks below it. The feeble current flowing southwards along the coast of North America, and known as the “Cold Wall,” is no longer regarded as the continuation of the Labrador Current. These cold currents from the north chill the coasts of Labrador and Newfoundland, and give them very bitter winters. They also bring with them thousands of icebergs, which play an important part in modifying the climate of these northern lands.

The air above the Gulf Stream is warm and saturated with moisture. The air above the Labrador Current is cold. When the two air currents meet, a great deal of the moisture in the warm current is cooled and condensed, and fogs are formed. “Every sailor who passes the coast of Newfoundland knows this region of mist and moisture; it is the region of the Newfoundland fogs, and is dreaded by all who have to navigate the waters over which its misty curtain extends. For many miles the ships have to pass through the dense fog-banks, and to the danger of collision between two ships is added the still greater danger of collision with the sides of the great floating icebergs” (Arnold Foster).

Notice the way in which the waters of the Atlantic circulate. North of the Equator the circulation is in the same direction as the hands of a watch. Is this the case south of the Equator?

Stir a cup of tea with a teaspoon till you have made the tea circulate. Where do any floating leaves collect? Why Find on your map the position of the Sargasso Sea. This is a comparatively still area, enclosed by the

great Equatorial Current and the Gulf Stream. Floating substances have a tendency to collect in such an area and form a vast accumulation of rubbish. Amongst this rubbish masses of seaweeds are found.

Currents of the Pacific. There is an **Equatorial Current** caused by the Trade Winds and flowing westwards along and in the neighbourhood of the Equator. It divides off the East India Archipelago. One branch, the **East Australian Current**, passes along the east coast of Australia. The other branch turns north, passes China and Japan, and arrives at Bering Strait. It sends off a branch which leaves Japan for the west coast of North America, flows down that coast beyond the Tropic of Cancer, and then turns west to join the North Equatorial Current. This is the **Japan Current**, which, off the coast of Japan itself, is known as the **Kuro Sivo**. It is sometimes called the "Gulf Stream of the Pacific." Compare its course with that of the Gulf Stream. Note from what main current each branches, in what latitude the branching takes place, the general direction of the current, the position of any islands washed by its waters, the position and direction of the current with which the stream finally unites.

The **Mexican Current** is a current flowing along the coasts of Mexico and Central America.

Currents of the Indian Ocean. North of the Equator the currents are variable and uncertain, changing their directions from time to time with the monsoons. South of the Equator the currents are similar to those in the South Atlantic and South Pacific Oceans. The **Equatorial Current** flows westwards, and divides off the Mauritius. It sends two branches to the south, one to the east of Madagascar, and the other through the channel between Madagascar and the mainland. These two branches unite again off the coast of Natal and form the **Agulhas Current**, which is afterwards deflected to the east.

Currents of the Arctic Ocean. We have already spoken of the cold currents flowing southwards along the coasts of Greenland and Labrador. During Dr. Nansen's expedition (1893-6) it was proved that there is a drift of ice right across the polar seas from the sea north of

Siberia towards the sea between Spitsbergen and Greenland.

Currents of the Antarctic Ocean. The **Antarctic Drift** is a cold current which flows in an easterly direction right round the globe. At different points in its course it sends off branches to the north. The three chief branches are as follows:—(i) The **Peruvian Current**, flowing northwards along the west coast of South America, and 8° to 10° colder than the ocean through which it flows. What current does it finally join? (ii) The **Benguela Current**, flowing northwards along the west coast of Africa. What current does it join? (iii) The **West Australian Current**, flowing northwards along the west coast of Australia. What current does it join?

REVISION EXERCISES

1. (a) Cape Town is in latitude $36^{\circ} 56' S.$, longitude $18^{\circ} 28' E.$ Explain fully what this means (b) Explain the terms—Gulf Stream, volcano, peninsula. O. J., 1893.
2. What are the chief modes of land transport employed in different parts of the world? Give examples of regions in which each of the modes you mention is important, and explain why it is used in preference to others. O. S., 1907.
3. Draw a map of the United States, marking on it the great rivers, lakes and mountain ranges; also the positions of these towns: Charleston, Chicago, Detroit, Omaha, Portland, San Francisco, St. Louis. C. S., 1892.
4. What are the movements of the different ocean currents in the Atlantic and how are they caused? C. J., 1889.
5. Explain shortly how ocean currents are formed and trace the origin and course of the Gulf Stream. By what currents and in what manner is the climate of (a) the east, (b) the west coast of North America affected? What is the Sargasso Sea? C. J., 1894.

CHAPTER X

THE MOON—THE MONTH—THE TIDES

THERE are other movements of the sea besides those which we call currents. There are waves, and tides. Waves are produced by the wind. The tides are produced by the sun and the moon. Before studying the way in

which the moon produces or helps to produce the tides, let us get a little information about that body itself.

The moon is the nearest heavenly body to the earth and revolves round the earth. It is about 240,000 miles away on the average, but as the moon's orbit round the earth is an elliptical one, it is sometimes nearer to us and sometimes further away. The volume of the moon is about one forty-ninth that of the earth.

Notice the position of the moon with respect to a particular star, on several evenings in succession. You will see that the moon moves to the **east**, and that every night it rises **later**. Wait for it to come back to its original position with regard to the star, that is, for it to make one complete revolution round the earth. You will have to wait 27 days 7 hours 43 minutes 14·5 seconds. This is the length of a **sidereal month**.

The moon shines with borrowed light, which it gets from the sun. When the moon is on one side of the earth and the sun on the other, then the moon is fully illuminated to us and we see **full moon**. When the moon is between us and the sun, the illuminated side is away from us and then the moon is **new**. As it revolves from new moon to full moon the illuminated part as seen by us gets larger. As it revolves from full moon to new moon the illuminated part, as seen by us, gets smaller.

When the earth is between the sun and the moon in a direct line, a shadow of the whole or a part of the earth is thrown upon the moon and we have a **lunar eclipse**. When the moon passes directly between the sun and the earth, a part or the whole of the sun's surface is blotted out and we have a **solar eclipse**. If the moon moved in the plane of the ecliptic, the sun, the earth and the moon would often be in a straight line with one another and eclipses would be frequent. But as the moon's orbit cuts the plane of the ecliptic at an angle of 5° , it is only very rarely that the sun, the earth and the moon actually get into the same straight line.

If you have ever been to the seaside, you have noticed that the water of the sea rises and falls twice in every twenty-four hours. When the water is at its highest point, we

have high tide, or high water. When it has ebbed away to its lowest position we have low tide or low water. High tide does not occur at the same hour every day. It is usually about one hour later each day.

We have said that the tides are caused by the moon, and we have now to explain how. Every body in the universe—sun, moon, stars, planets, big things and little things—tries to attract every other body towards it. The earth attracts the moon and the moon attracts the earth. The sun, in like manner, attracts and is attracted by the moon and the earth and so on. The force of attraction between two bodies depends on their masses. We have already seen that the *volume* of the earth is forty-nine times that of the moon. The *mass* of the earth, however, is eighty times that of the moon. Therefore, if the earth and the moon act upon a given body which is at the same distance from both, the effect of the earth upon that body is eighty times as great as that of the moon. The attraction also depends upon the distance between the bodies. If the distance between the earth and the moon were halved, the attraction would be four times as great as it is now. If the distance were doubled, the attraction would become only one quarter of what it is now. The force of attraction between two bodies varies inversely as the square of the distance.

The sun is 26 million times heavier than the moon, so that if size were the only thing that counted, the attraction between the sun and the earth would be much greater than that between the earth and the moon. But then the sun is 400 times as far away from the earth as the moon is, so that the effect due to its size is diminished by its enormous distance. The effect of the sun in causing tides is, however, only about five-elevenths of that of the moon, "for the sun acts upon the earth as a whole, while the moon acts more particularly and intensely on the limited part of the earth directly under her."

Imagine that the earth is at rest and covered uniformly all over with water. The water at B is nearer the moon than the centre of the earth, A. The moon therefore attracts

the water at B more than it attracts the earth at A. So the water gets heaped up at B and there is a high tide at that place. The centre of the earth, A, is nearer the moon than the water at C, and so is drawn towards the moon more than the water at C. The result is that the

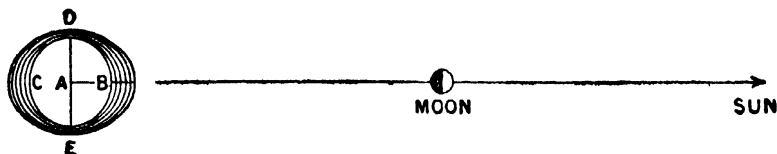


FIG. 31.—TIDAL ATTRACTION OF THE MOON AND SUN.

water gets left behind a little and is heaped up to form a high tide at C. Between these two places at D and E there is low water. If there were no land to interfere, as the moon moved round the earth, high tide would always occur when the moon was on the meridian. Tides formed by the combined action of the sun and moon are the highest of all and are called **Spring Tides** (Fig 32). They occur at full and new moon.

At times, however, we get a condition of things something

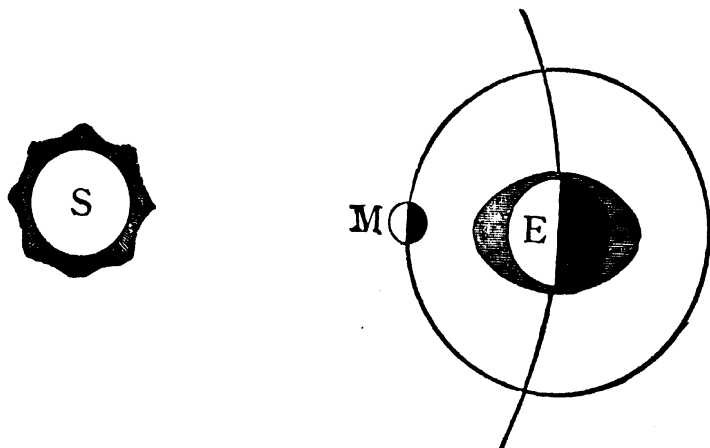


FIG. 32.—SPRING TIDES ; MOON AND SUN ACTING TOGETHER.

like that represented in Fig. 33. This occurs when the moon is in its first or third quarter. In this case the moon and the sun are opposing each other and the tides everywhere are much lower. These lower tides are **Neap tides**.

The time which elapses at any given place between one high tide and the next is called the **establishment of a port**.

The subject of tides is in reality less simple than the above few facts might lead you to believe. Owing to the presence of the continents, the rotation and revolution of the earth, the revolution of the moon, and other causes, the tides do not move quite in the way you might expect them to do. In the Atlantic Ocean, for instance, the tides

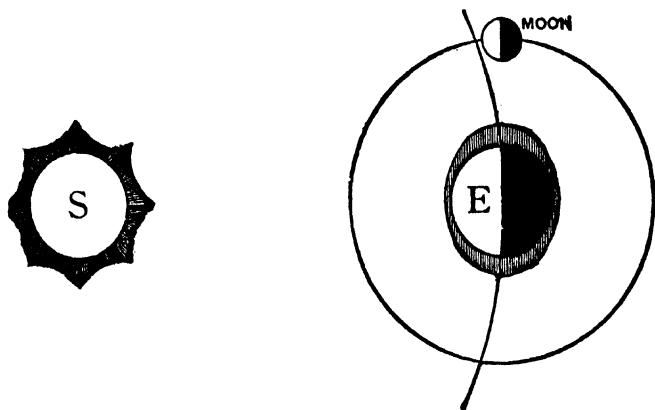


FIG. 33.—NEAP TIDES : MOON AND SUN ACTING IN OPPOSITE DIRECTIONS.

do not move from east to west, but from *south to north*. Near the continent of Europe they move from *west to east*.

If we draw on a map a series of lines joining all places that have high water at the same time we get what are called **co-tidal lines** (Fig. 34). The given figure shows the times at which high water occurs at new and full moon and also the rate at which the tide wave progresses round the coast of the British Isles. The zigzag line IV which passes the south of Ireland, the Scilly Isles and part of Brittany shows that all the places along that line have their high tide at the same time and that at the time of either full or new moon, this occurs at 4 o'clock.

Consult the co-tidal map given for the British Isles (Fig. 34), and notice that the tidal wave divides when it reaches our coast. One part goes round by the north of Scotland and then south along the east coast of Great Britain. The other branch passes up the English Channel. They meet

off the mouth of the Thames, but the tide that has travelled round Scotland is 12 hours older than the one that has travelled through the Channel.

At what hour does the tidal wave passing the Scilly Isles

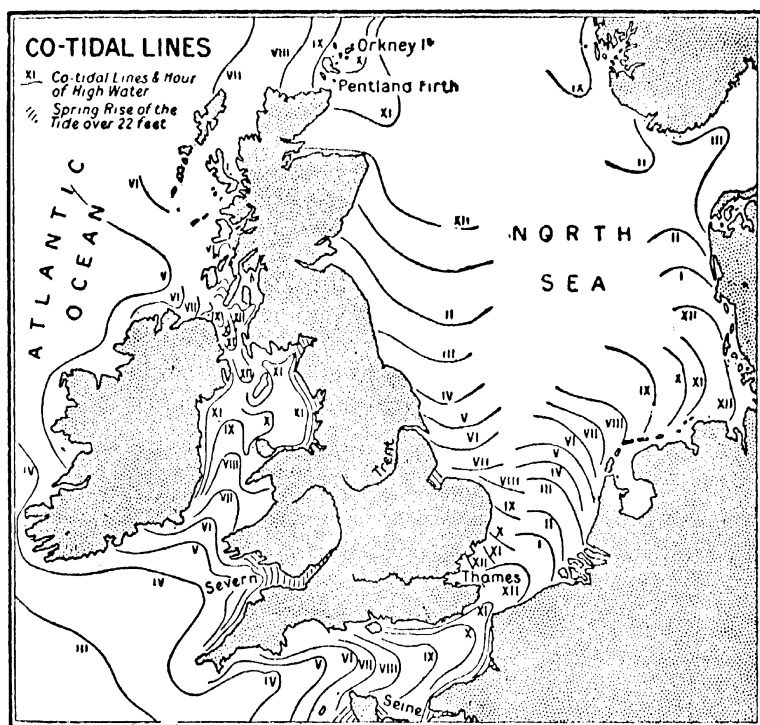


FIG. 34.—MAP OF BRITISH ISLES, SHOWING CO-TIDAL LINES.

at 4 p.m. reach (a) the Hebrides, (b) the Shetlands, (c) Dundee, (d) Yarmouth, (e) Dover?

How many hours after high water at Ushant will there be high tide at (a) Cherbourg (b) Havre, (c) Dieppe, (d) Calais?

Height of Tide. In the middle of the Pacific Ocean the tide sometimes rises less than a foot: in the Atlantic Ocean, near to St. Helena, it rises about 3 feet. Where the tidal wave meets great masses of land, or where it enters the mouth of a river, it gets heaped up as it rushes onwards, and in such cases it frequently rises to great heights. In the Bay of Fundy, for instance, the rise is sometimes as great as 50 feet. The rush of water up the

estuary of a river, caused by the inflowing tide, is called a **bore**. Under certain conditions it "rolls up the channel of the river with a velocity so great as to overpower the descending stream, advancing in many cases with a noise like the rolling of distant thunder, and not unfrequently occasioning destruction to any shipping that is exposed to its influence" (*Class Book of Physical Geography*. Hughes). A tidal bore occurs at the mouths of the Severn, Trent, Elbe, Weser, Seine and Garonne, and of many other rivers.

If the passage into which the tidal wave flows is not a closed but an open one, it rushes through the passage like a rapid. One of the best examples of this to be seen in the British Isles is at the Pentland Firth, between the Orkney Isles and the north of Scotland. "Standing at high or low water on one of the headlands overlooking that narrow passage, you look down upon a strip of blue sea about six or eight miles broad, opening westward into the wide Atlantic and eastward into the North Sea. As soon as the tide begins to flow or to ebb you observe this smooth belt of water to become more and more troubled, until when the motion of the tide is at its height, it sweeps past at a rate of eleven miles in the hour, boiling up and foaming along like some vast river. Here and there, where sunken rocks lie in the path of the current, the tumult of the water is strongest, while, should a high wind be blowing against the tide, huge waves and sheets of foam are tossed high into the air, and the whole surface of the firth becomes white with breakers. No small vessel can then attempt to force its way through the strait" (*Physical Geography*. Geikie).

REVISION EXERCISES

1. Write a short account of (i) the Gulf Stream, (ii) the Labrador Current. C. J., 1897.
2. Great Britain produces large quantities of salt. Where is the salt chiefly found, and how is it obtained? O. S., 1907.
3. Mark on a map the boundaries of the following provinces: British Columbia, New Brunswick, Ontario; insert and name the following towns: Halifax, Hamilton, Montreal, Quebec, Vancouver. Mark the position of and name the Rocky Mountains, the Bay of Fundy, James' Bay, Cape Breton, the strait of Belle Isle, Niagara Falls, Lake Winnipeg, and insert four rivers. C. J., 1900.

4. A ship ran aground on a sandbank off the French coast just at high tide on a certain day and was got off at high tide on the next day. Explain when this would be more likely to happen, shortly before or shortly after the time of full moon. About how long did the ship remain aground ? O. J., 1905.

5. In what respects do tides differ from ocean currents ? How is it that tides produce great currents in some places, e.g., in the Trent, and at the mouth of the Severn ? O. J., 1896.

CHAPTER XI

NORTH AND SOUTH AMERICA

POSITION

In this section of the second part of this book we propose to consider America as one continent, although it is usually described as two, viz. North America and South America. You will sometimes find it convenient to use a map showing the whole of the Western Hemisphere and at other times separate maps of each of the continents, or even of the several countries in these continents.

Roughly speaking, each continent is of triangular shape. In which direction do they point ? Name what you would consider the angular points of each continent.

Within what parallel of latitude does the north coast lie ? Within what parallel of latitude does Cape Horn lie ? How many degrees of latitude are there from the extreme north to the extreme south ? What line crosses in latitudes $23\frac{1}{2}^{\circ}$ N. ? 0° ? $23\frac{1}{2}^{\circ}$ S. ? What meridian of longitude runs almost through the middle of North America ? through South America ? Look at the meridian 80° W. Compare the positions of South America and North America with regard to this line. Between what meridians of longitude does North America lie ? South America ?

Find from the tables given in Chapter II and by reference to your map, about how far it is from San Francisco to New York, from Pt. Barrow to Cape Sable (in Florida),

A RATIONAL GEOGRAPHY

from P. Parina to Cape San Roque, from Pt. Gallinas to Cape Horn.

What continent does North America nearly touch in the north-west? What strait separates it from this continent? Where is North America nearest to Europe? How far is Hudson Strait from the North Pole? New Orleans from the Equator?

Notice the absence of land boundaries. The cutting of the Canal through the Isthmus of Panama has made the continents virtually islands. What ocean washes the northern shores? the eastern? the western? What effect would you expect the presence of so much water to have on (a) climate, (b) occupations, (c) national defence? The east coast of North America has many peninsulas and arms of the sea. Is this the case for South America?

Draw in each continent a circle with a radius of 1,000 miles. Draw the circles so as to include as much land as possible. Are there many places more than 1,000 miles from the sea?

Is the broadest part of North America in tropical, temperate, or arctic regions? Answer the same questions for South America.

The whole land mass is four times as large as Europe and half as large again as Africa. The land is almost equally divided between the two continents.

REVISION EXERCISES

1. Describe the principal ocean currents of the North Atlantic and their effects on the climate of Western Europe and Eastern North America.

C. J., 1906.

2. In some parts of the British Isles the surface consists of limestone or of chalk. State the positions of some of these parts, and point out any peculiar features about the rivers which flow over them.

O. S., 1907

3. Draw a map of that part of South America which is north of the equator. Distinguish the different states, mark the chief physical features and the chief towns and give their names; mark and name the islands near the coast as far north as Barbados; distinguish all British dependencies by their names.

C. S., 1893.

4. The areas given in square miles of the following continents, etc.

North America	8,250,000	square miles.
South America	7,000,000	" "
Europe	3,750,000	" "
British Isles	nearly 121,000	" "

On any scale you like draw a rectangle to represent the area of North

America. Inside this one, with two of its sides lying on two of the sides of the first, draw another rectangle to represent the area of South America and so on, for Europe and the British Isles.

5. What are the chief industries carried on at the following places and how far do they depend upon geographical position? (a) Glasgow, (b) Cork, (c) Middlesbrough, (d) Sunderland, (e) Merthyr Tydvil, (f) Dundee.

O. J., 1904.

CHAPTER XII

SURFACE

EXAMINE a physical map of the Western Hemisphere. Find Alaska in the north-west of North America. Here you will notice the beginning of a chain of mountains, or rather, of a series of mountain chains and plateaus. Follow the system southwards. It runs near to the west coast through British North America, the United States of America, Mexico and Central America. There is a break in the system in the neighbourhood of the Isthmus of Panama, and then it reappears again in South America and runs through the whole length of the continent. Here you have a great watershed which runs north and south. (In what direction does the main watershed of the continent of Europe run?) Now examine the east coast of the continent. In the United States there is one highland region parallel to the coast, and in Brazil there is another. Both these highland regions run more or less to the north-east, and both are near the sea, with a steep slope towards the ocean and a gentler one towards the land. But the first is a series of parallel ridges, while the second is a highland region topped by numerous ranges. The eastern systems are not nearly so high as the western, but they are very much older. In the course of the centuries they have been worn away by the action of frost and rain, till little is left beyond the remains of a plateau and a few irregular ranges of hills. The western system is comparatively young. Most parts of it are still growing. Volcanic action is of frequent occurrence in many parts of the chain, and even where the volcanoes are extinct there is evidence that

they have only become so in, what we may call geologically, quite recent years.

In South America there is another highland region near to the north-east coast, covering a great part of Guiana. In what direction does it run ?

Between the walls of mountains lie great plains which stretch, except throughout Mexico and Central America, almost from pole to pole. Thus you see that there is a very striking general resemblance between the surface of North America and that of South America.

In North America the main axis of the continent is called the **Rocky Mountains**. You are not to think of these mountains as an isolated chain, having no connexion with the other mountain chains. They consist of a double and sometimes a triple line of ranges, and they form the outer edge of a system comprising other high ranges and high plateaus lying between them and the west coast, and which extends from north to south. The whole system is included under the name, the **Cordilleras**.

Use blank maps and insert the various ranges, peaks, plains, etc., as mentioned. Make a list of all the high peaks you find in any of the systems, tabulating them as follows :—

Name.	Height.	In what chain.	In what country.
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Mark with distinct lines the main chains of the **Rocky Mountains**, **Cascade Mountains**, and the **Sierra Nevada**. The area enclosed by these mountains varies both in height and breadth. Is it broad or narrow in Alaska ? What high peaks are there in Alaska ? One of these, **Mount McKinley**, is the highest mountain in North America. In this part of the system the mountains are covered with snow, and the valleys are filled with enormous glaciers that penetrate into the sea in a series of steep walls of dreary forbidding ice. Farther south are the **Cascade Mountains**, a long line of extinct volcanoes. The scenery

of this district is almost unrivalled, being a wonderful combination of brown cliffs, dark pines and white snow. In the **Sierra Nevada** range, the snowfields and the glaciers are much smaller, as the mountains lie in warmer latitudes. What peak stands near their southern end? It is the loftiest peak in the United States. The coast ranges are fairly continuous, except where the rivers have cut a way through to the sea.

Mexico consists of a high plateau, except for a narrow coastal strip on either side. The strip along the Gulf of Mexico is generally wider than that on the Pacific coast. What mountains form the western edge of the plateau? There are a number of isolated high peaks in the country, and many of these are volcanoes. The highest summits are **Orizaba** and **Popocatepetl**.

Central America contains rough high plateaus in the centre, but has a narrow plain on the Pacific coast and a wider swampy plain on the east coast. As in Mexico, many of the mountains in this part of the system are active volcanoes. Like all countries which contain active volcanoes, Central America suffers from frequent earthquakes.

The chief summits in the Andes, even on the Equator, are all above the snow line. In the northern part of the system there are three distinct chains. Then further south they become two, and finally one. Just south of Quito is **Chimborazo** (20,500 feet), one of the many volcanoes of the chain. Near what important line does it lie?

Another famous volcano is **Cotopaxi**. There are twenty-nine volcanoes in this part of the range, each higher than Mount Etna. Cotopaxi itself is five times as high as Vesuvius. When it was last in eruption (1879), it covered the neighbouring country with three feet of pumice stone, turning the whole region into desert. It threw a rock weighing forty tons for a distance of twenty miles.

Between the two main chains, in that part where the range is double, lies **Lake Titicaca** at a height of over 12,500 feet. At this point the system is 500 miles wide, and contains thirty-two summits, each above 17,000 feet high. There is enough rock in this part of the chain to cover the rest of South America to a depth of 378 feet,

The highest peak lies south of the Tropic of Capricorn, and is called Mount Aconcagua (23,000 feet). It is the highest peak in South America, and was first climbed in 1897. In Patagonia the average height of the system diminishes and the mountains approach the sea. In places they rise abruptly from the sea-level, and narrow fjords similar to those of Norway wind in and out of the low-lying valleys.

The Andes are not so lofty as the Himalayas, but they are three times as long, extending as they do for 5,000 miles. They are more continuous than the Rocky Mountains, have a greater average height, and contain more lofty peaks and more volcanoes. They are one of the most difficult ranges in the world to traverse, and in the central parts the passes are so high that the crossing is attended by many dangers.

“One important feature of the Andes—regarding the system as a whole—is their coincidence with a vast line of subterranean heat. In no other part of the world are there so many active volcanoes, and nowhere else is the destructive force of the earthquake experienced with so much frequency or with such tremendous power. Earthquakes are of frequent occurrence in most parts of the Andean region” (*Class Book of Physical Geography*. Hughes).

The eastern systems of mountains are of less importance than those on the west. The one in the United States is called the **Appalachian System**, and its chief ranges are the **Alleghany Mountains**, which are not a single chain, but a series of parallel ranges with fertile valleys between. This system contains rich stores of coal, iron and petroleum. The eastern highlands of South America belong to the **Brazilian System**. This system consists of a high plateau, which was probably at one time connected with the high land of Guiana. There was then a low-lying area enclosed by high ranges, and containing an inland sea. What river now runs through the old sea basin? On the plateau there are a number of ranges, which radiate from a central spot. What large town stands near the point from which the several ranges radiate?

In each continent there is a mountain system running in a direction more or less east and west. In North America the range is known as the **Laurentian Heights**. These mountains, like those of Brazil, are amongst the oldest mountains in the world. They begin in Labrador, bend towards the Great Lakes, and then run round the southern and western shores of Hudson Bay. They do not often rise above 1,500 feet, and in most places they are very much lower.

The corresponding system in South America runs through Guiana and parts of Venezuela. It consists of a plateau traversed by several ranges of forest-clad hills, from which many rivers descend in cataracts and rapids to the plains at their feet.

Plains and Plateaus. Refer again to the physical map and note the region to the west of the Rocky Mountains, a region of high land, mountain chains, and enclosed valleys. This is sometimes called the **Great Western Plateau**. Name its boundaries. It extends from Alaska to California. The broadest part of it, the **Great Basin**, is an area of inland drainage. As the rivers flow inland and not to the sea, the surplus water can only be got rid of by evaporation. Hence the lakes contain salt water and not fresh. The largest of them is called the **Great Salt Lake**.

The **Atlantic Coast Plain** lies between the Alleghany Mountains and the Atlantic. It measures about 900 miles from north to south, and has an average breadth of about 200 miles. The seaward slopes of the mountains are very steep; the plain lies at a low level; the area is one of heavy rainfall. Hence marshy tracts are common. Name a few important towns on this plain.

Both North and South America contain a series of enormous plains, filling up the greater part of the land area. In the far north we have a district of **tundra**, similar to that in the north of European Russia. The tundra covers all the land from the Arctic coast to the forest belt. It is a swamp in summer and is then gay with mosses and lichens; but in the winter it is one bleak, dreary, white wilderness, buried in snow and swept by freezing Arctic winds. The

land rises very gradually from the shores of the Arctic Ocean, and reaches its highest point in the latitude of Lake Superior. There is, in this latitude, a low ridge, so low that it is not usually marked on a political map of North America, and yet it forms a distinct and important watershed, dividing those rivers that run to the north from those that run to the south and the east. The greatest height in this ridge of land is no higher than Dartmoor. Coming further south we get to the great **prairie** district, which embraces the land round the headwaters of the Saskatchewan, Missouri and Mississippi. It lies west of Chicago and north of St. Louis. On its western edge a series of smaller plains rise gradually along the slopes of the Rocky Mountains. These are higher, and drier, but less fertile than the prairies. The word "prairie" means "meadow," and is the name given by the early French explorers to the vast plains which lie in this part of North America. On the prairies there is very little timber. The ground is covered with an abundance of long, rank grass, mingled with a wealth of beautiful flowers. The grass affords excellent pasture, even in the dry season. At one time these extensive plains formed the chief dwelling-place of the North American Indians. Here they hunted the enormous herds of bison, deer, buffalo, elk, and antelope. Cattle have now taken the place of the wild animals, and where water is abundant the grass has given way to wheat.

The most southerly part of the North American lowland is round the shores of the Gulf of Mexico. It contains numerous and unhealthy swamps.

In South America the northerly section of the low-lying area is called the **Llanos**. This is the Spanish name for the vast plains of the basin of the river Orinoco. The chief characteristics of this region are park-like grass, clumps of trees, and rivers fringed with beautiful woods. There is an abundance of good grass, which grows rapidly during the short wet season, and forms a rich natural pasture ground.

In the basin of the Amazon we have the region of the **Selvas**, great forest-covered plains with dense, damp, dark jungle. It is a region of tremendous heat and rainfall.

The southern section is filled with the **Pampas**, which,

like the prairies of North America, are wide expanses of treeless grass-covered land. They extend from the Andes to the Atlantic and lie between 30° S. and 40° S. What river runs through the Pampas? After rain the plains are covered with the richest grass, which supports large numbers of wild horses and cattle. One of the chief grasses is the tall, feathery pampas grass, which stands over nine feet high. "The solemn silence of these level seas of grass and flowers, and the grandeur of the sunsets, make the people living on the pampas love their country passionately" (Mill).

Most of these plains have an average elevation of under 600 feet, and none of them have an average elevation of over 1,000 feet.

REVISION EXERCISES

1. What is dew? Explain why it is formed at night and why it disappears as the sun shines on it. O. P., 1900.

2. Draw a map of the Thames and its tributaries below Reading and above Gravesend. Show the North Downs and the Chiltern Hills. Mark the position and name a town at each gap where a river crosses the North Downs. L. J. S., 1904.

3. Draw a map of South America, insert the chief mountain chains; the rivers Parana, Amazon; and mark the position of Cayenne, Monte Video, Quito, Bahia, and Valparaiso. O. S., 1892.

4. Give a short description of the table lands of South America, pointing out the relative elevation of the different districts. Name also the regions traversed by earthquakes and the principal volcanic summits. C. S., 1888.

5. Give brief descriptions of the Pampas, the Llanos, the Selvas of the Amazon, the Steppes of Southern Russia. C. J., 1898.

CHAPTER XIII

RIVERS AND CANALS

TAKE a blank map of North America. Draw the following lines on it:

- i. The main chain of the Rocky Mountains.
- ii. From Robson's Peak to Churchill on Hudson Bay.

- iii. From a point in the Rocky Mountains (50° N.) to the west end of Lake Superior.
- iv. From the west end of Lake Superior, along the northern boundaries of Ontario and Quebec to about the middle of the shore of Labrador.
- v. From the west end of Lake Superior, round the great lakes, parallel to the St. Lawrence and ending at Bathurst in New Brunswick.
- vi. From Bathurst through the Alleghany Mountains and then round to the east coast of Florida (latitude 30° N.).

These lines include the main watersheds of the continent and enclose six river basins, in each of which one or more important rivers flow to the sea. Insert the rivers and all places named as you come to them in reading the rest of this chapter.

(i) **The Rivers of the Pacific Coast.** In what mountains do they rise? Will they be comparatively short or long? rapid or slow? useful to commerce or not? Is the watershed mainly within or without the tropics? What winds bring the rain to supply the rivers? The rivers flowing from the Rockies to the Pacific are true "plateau" rivers and flow through deep, perpendicular valleys called cañons.

Yukon. Where does it rise? end? Through what country does it flow? What mining town stands on its banks? In summer it is navigable for 1,000 miles, but is frozen over during the winter months.

Fraser. Where does it rise? end? What ports are on or near its mouth? What country does it flow through? What island is opposite its mouth? It flows through winding valleys, one of which is the Fraser Cañon, a gorge so deep that the sun hardly reaches the river, where the cliffs rise up like walls and the waters roar like thunder.

Columbia. Through what states does it flow? In what mountains does it rise? Through what range has it to find a gap to get to the sea? This river provides the only natural route through the volcanic snow-clad coast range.

Colorado. What states does it flow through after

leaving Colorado ? Into what gulf does it flow ? It crosses a practically desert plateau, an expanse of gray, red, or brown rock, without a single tree or a blade of grass. In one part of its course it flows through the Grand Cañon. The cañon has been cut by running water. As the district is dry there is no drainage from the sides to wear away the banks, so that the banks are almost vertical. The Grand Cañon is more than 200 miles long. The banks are too steep to be climbed and in places are a mile high. The bottom of the cañon is dark and gloomy. The roar of the waters is deafening. Here and there huge ledges of rock run along the sides of the valley, and in some parts there are stone dwellings cut in the cliffs, that show that this now deserted region was once partially occupied.

On the north-west lies an area of inland drainage, where the rivers run inland and not to the sea. In one of the big hollows lies the great Salt Lake, near which stands the beautiful Salt Lake City. The desert character of this region is due to want of rain. When, as in the neighbourhood of Salt Lake City, artificial irrigation has been adopted, the desert has been made to blossom as the rose.

(ii) **Rivers flowing to the Arctic Ocean.**

This basin is bounded by the Rockies and a low ridge of land running in the direction in which you have drawn one of your lines. Why are the rivers flowing into the Arctic Ocean of no commercial value ? The chief river is the **Mackenzie**. It has several names in different parts of its course. It is at first called the Athabasca. Near what peak does it rise ? Through what territory does it flow ? In its course it connects several lakes. Name them. In the summer the melted snows from the mountains drain into the upper part of the river, but as the lower part is still icebound, the water cannot get away and it floods the plains. Before all the flood water has gone, the winter comes again and converts thousands of square miles into a frozen marsh. Here we have an instance of a river which does at least as much harm as good.

(iii) **The Basin of the Saskatchewan.** Near what peak does the Saskatchewan rise ? In what direction

does it flow? Where does it end? What port stands at its mouth? What is the river called in the lower part of its course? What lakes does it drain?

(iv) **The Basin of the St. Lawrence.** The St. Lawrence is at first called the St. Louis. In what direction does it flow? What is the first large lake it enters? This is the largest fresh-water lake in the world. It is as large as Ireland, and a fast steamer takes twenty-four hours to cross it, and during much of the time the passenger is out of sight of land. The lake is subject to fogs and to sudden and violent storms. What is the next lake called? Lake Superior is 20 feet higher than Lake Huron and the river is beset with rapids, so that a canal, containing many fine locks, has been made to connect the two lakes. The largest locks are at Sault (pronounce *Soo*) St. Marie. What large lake lies west of Lake Huron? After leaving Lake Huron the river is called the St. Clair. It runs into a small lake of the same name. What town stands south of Lake St. Clair? It is an important railway junction, and as it is within easy reach of supplies of iron and timber from Michigan it makes railway stock. Into what lake does the river flow after leaving Detroit? What American town stands at the eastern end of the lake? This town is the terminus of the Erie Canal. It commands the trade between New York and the St. Lawrence, and the railway traffic along the southern shore of Lake Erie. What falls are marked on the map between Lake Erie and Lake Ontario? They are 160 feet deep, and the noise of the falling water can be heard far away from the river. The spray is dashed high into the air, and rainbows are seen spanning the cataract. During the winter the falls are partly frozen, and the trees, rocks and other objects in the neighbourhood are cased in frozen spray. The whole place is wrapped in a covering of the purest white, and glitters in the winter sunlight like a field of jewels. The waters of the falls and of the river provide the power to drive machines that supply an inexhaustible quantity of electricity. In the town of Buffalo, 22 miles away, all the mills are worked and all the street cars run by electricity, produced

in this way. After leaving the falls, what lake is entered? At the other end stands Kingston. From this town the Rideau Canal runs to Ottawa. Note the islands in the river, east of Kingston. These are "The Thousand Isles," a favourite resort of summer pleasure seekers. Between the islands and Montreal there are many rapids that can be avoided by canals, but which steamers on the seaward journey usually "shoot." Through what province does the St. Lawrence flow after passing Montreal? What island is at its mouth? In what gulf is this island? What happens to the mouth of the river in winter?

(v) **Rivers of the Atlantic Plain.** What mountains form the western watershed of this basin? What winds bring the rain supply? The country is low and level and the rivers though short are useful. They are conveniently situated for trade and they run north and south. They are often too rapid for easy navigation but they supply abundant water power. The chief river is the **Hudson**. Where does it rise? end? What port is at its mouth? what island? It is navigable for only 150 miles, but by means of the Erie Canal it connects New York with Buffalo and the lakes, and by means of the Champlain Canal it connects New York with Montreal. It is so beautiful that it is called the "American Rhine."

(vi) The largest basin of all is that drained by the Mississippi and its tributaries.

The Mississippi drains half the total area of the United States. In what State does the Mississippi rise? In what direction does it flow? Name all the States it passes through or between. For 400 miles the river winds from one small lake to another, and then filters through swamps and pine forests. It is joined by numerous streams and gradually widens. The first large town is the double city of St. Paul and Minneapolis, where the river descends in the Falls of St. Anthony. These falls provide water power for driving the flour mills, which are situated in the midst of the richest wheat area in the States. The climate of this area is very dry and therefore suitable for the manufacture of flour. The flour can be sent directly away to the Gulf of Mexico. The twin city stands at about

equal distances from the Atlantic, the Pacific, the Gulf of Mexico and Hudson Bay. Its central position makes it a convenient place for the reception and distribution of all kinds of produce. What is the distance in a direct line from St. Paul to St. Louis? What tributary runs in at St. Louis? The next 600 miles is through a broad plain that has been built by the river itself. The land is very low and often flooded. Sometimes these floods are so deep and swift as to bring ruin to all within reach of the destructive waters. At Cairo another tributary flows in. Name it. The river now flows on through cotton and sugar plantations. Two streams enter on the right bank. Name them. In what direction does the Mississippi turn after receiving the Red River? What port is on the delta? About how far is this port from the mouth of the river? The mud brought down by the river discolours the sea fifteen or sixteen miles from land. So much mud is deposited in the bed of the river itself, that the bed has been considerably raised, and this has necessitated the making of dykes for hundreds of miles in the lower parts of the river.

Two of the tributaries of the Mississippi deserve special mention. These are the Missouri and the Ohio.

Missouri. The Missouri rises in the Rocky Mountains. In what direction and through what States does it flow before reaching the Mississippi? From the source to St. Louis is 3,000 miles, which is much longer than from St. Louis to the source of the Mississippi. Ships can get almost to the Rockies, a distance of 4,000 miles from the Gulf of Mexico. The volume of the river is very much smaller than one would expect from its length owing to the want of rain, the loss by evaporation, and the loss by absorption in the porous soil through which it flows.

Ohio. Where does it rise? In what direction does it flow? Through what States? At what town does it join the Mississippi? What mountains form the watershed on the left bank? Find Pittsburg. From this point canals connect the river with Lake Erie and the St. Lawrence. As the river is navigable from the Gulf of Mexico to this point, an excellent water-way is provided through these rich and thickly-peopled districts. The chief towns

on the banks are : (a) Pittsburg. In what State ? It has abundant supplies of coal, iron, gas, oil, and limestone, and possesses the largest iron, steel, and glass works in America. (b) Cincinnati. In what State ? It stands on one corner of the great maize area and near to oak forests. This has led to the breeding of pigs and a large trade in pork. The town is sometimes called the "Queen City of the West," on account of its beautiful buildings.

Now take a map of South America and draw the following lines on it :

(i) The main chain of the Andes.

(ii) Along the southern boundaries of French Guiana, Dutch Guiana, British Guiana, Venezuela and thence directly across to the Andes.

(iii) From C. S. Roque along the mountains crossing Brazil to about latitude 15° S., then along long. 60° W., to latitude 20° S. and finally along latitude 20° S. to the Andes. These lines divide the continent into a series of river basins. The greater part of the several watersheds lies within the tropics, and the chief water supply is brought by the wet trade-winds. The three chief rivers of South America have their mouths towards the east. With what continents can they most easily communicate ?

(i) **Rivers flowing to the Pacific.**—Owing to the nearness of the Andes to the coast, none of these rivers are of any importance.

(ii) **The Orinoco Basin.** The Orinoco rises in the mountains in the south of Venezuela, in a district which is practically unexplored. In what directions does it flow ? Near the source the banks are covered with woods so dense that neither man nor beast can live there. Notice the position of the Cassiquare.

This tributary connects the Orinoco with the Rio Negro, one of the affluents of the Amazon. There are a number of other streams which connect the two river basins, but the Cassiquare is the most important. It is possible for boats to pass from the mouth of the Orinoco to the Negro, and so to the Amazon. The Orinoco terminates in a delta of fifty mouths, seven of which are navigable. The river can be ascended for about 1,000 miles and even at that

distance from the sea it is a mile wide. The country is low, and during the wet season the low land is flooded, and the Indians who dwell on its banks then take refuge in houses built in the trees. What are the plains of the Orinoco called?

(iii) **The Amazon Basin** is as large as Canada and provides hundreds of miles of navigable water. What do you know about the rainfall in this area? What are the forest districts of the basin called? Note on your map (a) that many streams from north and south unite in the northern part of Peru and form the Amazon, (b) and that many tributaries join it as it flows along. Note the directions in which these tributaries flow and hence how the land slopes on both sides. In what direction does the Amazon flow? Its course lies through miles and miles of dense forests where few people live. There is very little trade along either the main stream or its many tributaries.

Find the Madeira. Trace the course of this river back to its junction with the river Guapore, and then pass along the Guapore to the source of the latter river in Brazil. Only three miles of grassy plain separate the upper waters of the Guapore from one of the small affluents of the Paraguay River. During the wet season the two basins are actually united, and the Indians frequently pass from the one river to the other by means of their canoes.

In the estuary of the Amazon is the low island of Marajo. At the end of one of the channels between it and the mainland is the port of Pará. Almost the sole export of Pará is rubber. It is a busy place, as practically all the imports for the Amazon basin pass through it. The estuary of the Amazon is large enough to hold nearly the whole of Scotland. Measure the breadth of the estuary in its widest part and compare this with the length of the Thames. The funnel-shaped estuary experiences a tidal wave which advances as a wall of water from five to twelve feet high and at the rate of from ten to twelve miles an hour. The Amazon is not the longest river in the world, but it has the largest basin and the greatest volume. It discharges such a flood of water into the sea that the ocean

is discoloured for many miles, and even at a distance of 200 miles from the shore there is a perceptible current of comparatively fresh water.

(iv) **The La Plata Basin.** The Rio de la Plata is an immense estuary. What two rivers unite to form it? The larger of these two rivers rises under the name of the Rio Grande on the west side of the Brazilian coast range. What river joins it at Corrientes? Where does this affluent rise? The country through which it flows is fertile, low, and subject to floods. During the rainy season the river inundates the surrounding plains to a depth of ten or twelve feet. Find Asuncion. This is the capital of Paraguay and one of the oldest cities in the New World.

Where does the Uruguay rise? Through what countries does it flow?

The estuary of the Rio de la Plata is shallow, its banks are low, and it has no protection against violent winds from the south-east.

We have already referred to several **Canals** in the northern half of the continent that serve to link together important towns in Canada and the United States.

The Panama Canal. In 1881 M. de Lesseps formed a company to cut a canal across the Isthmus of Panama. Large sums of money were lost in this enterprise, and the company failed. A new company was formed in 1894, which nine years later sold its rights to the United States. The Canal is now completed and open to shipping. Steamers from New York to San Francisco are no longer compelled to go round Cape Horn, and they thus save 9,000 miles of sea journey. This means the cheapening of the products exchanged between Europe and the Pacific coasts of America.

The Panama Canal begins at Colon or Aspinwall on the Caribbean Sea. It follows the valley of the Chagres River for several miles, reaches by means of locks a height of 100 feet, and then descends to Panama on the Pacific coast. Colon or Aspinwall has connexion with the rest of the world by seven or eight lines of steamers, and is joined by railway with Panama.

Panama is an old Spanish city. On what gulf does it

stand? "Panama" hats are named after this city, but the best of them are made in Ecuador and Peru.

REVISION EXERCISES

1. What is meant by (a) spring tides, (b) neap tides? Under what circumstances do neap tides occur? L. J. S., 1906.
2. Name four rivers which flow into the Wash, three which flow into the Humber, and three which drain the east of Scotland, giving one important town on each of the ten rivers. C. J., 1900.
3. Draw a sketch map of the Great Lakes of North America, and the river St. Lawrence, marking the positions of the Niagara Falls, Toronto, Ottawa, Montreal, Quebec and Anticosti. O. J., 1900.
4. Describe the river systems of those parts of North America which are under the government of the United States. C. S., 1897.
5. Name the States which are wholly or mainly drained into the Rio de la Plata, and the principal rivers which unite to form it. Describe roughly the position and extent of the Andes. C. J., 1888.

CHAPTER XIV

COAST LINE

THE north coast of North America is icebound for practically the whole of the year, and is of no commercial importance whatever. There are many islands, divided from each other and the mainland by an intricate network of straits and sounds. Name a few of the largest islands and the passages between them. Many of the names of the islands and the channels are the names of brave men who risked or lost their lives in exploring this desolate region. What names of famous explorers can you find on the map?

The largest opening is **Hudson Bay**, named after a Dutchman, Henry Hudson, who discovered it. No one knows when or how this brave man died, for he was cast adrift by his own crew, who had mutinied against him. From Hudson Bay, ships can pass, at certain seasons of the year, through **Hudson Strait**. On the north of the strait is the island called **Baffin Land**. What strait separates the southern portion of this island from Greenland? About how wide is it?

The Atlantic coast may be said to begin in latitude 60° N. What cape is there? The first portion of the coast is the coast of Labrador, bordered by bleak cliffs. It has many bays, but they are useless, owing to the intense cold. What current bombards it with icebergs all the summer through? What large island is crossed by the parallel of latitude 50° N.? What strait separates it from the mainland? Sailing down this strait we arrive at the **Gulf of St. Lawrence**. What island lies right in the mouth of the river? In the same gulf there are two other islands. Name them. Note the position of the peninsula of **Nova Scotia**. What bay does it inclose? What do you know about the tides in this bay? What cape is at the southern end of the peninsula?

From the **Bay of Fundy** to **Cape Cod** there are many cliffs and a number of good harbours. The coast from Cape Cod southwards is low and sandy until we arrive in latitude 35° N. What cape is there? From this point we get a shallow incurve. The land is swampy and there are a number of lagoons shut off by low sandbanks. What peninsula projects southwards at the entrance to the **Gulf of Mexico**? What cape terminates it? From **Cape Hatteras** to **Cape Sable** the harbours were not naturally good, but they have been improved artificially in order to make them available for the commerce of this district. The peninsula of **Florida** is fringed with coral reefs inclosing lagoons. The strong current of the warm Gulf Stream favours the growth of coral.

After rounding Cape Sable we are in the wide oval curve of the **Gulf of Mexico**. The coast is everywhere low and swampy. At the mouths of the rivers are bars covered with forests. In other places there are coral reefs and lagoons. What delta is there in longitude 90° W. It terminates in a series of finger-like projections, through each of which a river finds its way to the sea. What peninsula points northward into the **Gulf of Mexico**? What cape terminates it? What gulf lies on the eastern side of the peninsula?

The coast next runs south and then east. In what cape does the eastern line terminate? What is its latitude? The next section of the coast belongs to the Isthmus of

Panama. It was formerly called the **Mosquito Coast**, because of the presence there of this fearful insect pest. What is the width of the isthmus in longitude 80° W. ? Just after the junction of the isthmus with South America we reach the **Gulf of Darien**. We run north-east to **Cape Gallinas**. By what mountains is this projection formed ? What gulf is on the eastern side of it ? Notice that the western side of the gulf is also formed by a part of the **Andes** system. Travelling east we arrive at a large island. Name it. It stands on the continental shelf. From the mouth of the **Orinoco** to the mouth of the **Amazon** the coast is one flat mangrove-covered swamp, 1,000 miles in length. It is about another 1,000 miles from the mouth of the **Amazon** to **Cape St. Roque**. By what mountains is this cape formed ? A little farther south is **Cape Branco**, the most easterly point of South America. This "elbow" of **Brazil** is bordered by a sandstone reef and the approach to the land from the sea is difficult. For many miles the coast bends in and out in a series of gentle incurves and out-curves. Behind all these is the mountain wall. There are a few good harbours but no important rivers. What estuary is there in latitude 35° S. ? From this estuary to the south there are many capes and gulfs, and a flat shingly beach. We pass the **Falkland Islands**, which stand on the continental shelf. Owing to the fact that the shores of these islands are deeply indented, they possess many good harbours. The best of these is **Port Stanley**. It is used as a whaling station and as a port of call for passenger ships. What strait lies between **Tierra del Fuego** (the Land of Fire) and the mainland ? This strait is bounded by steep bare cliffs. What island is the most southerly of the group in which the continent terminates ? What cape ? It is generally wreathed in mists and snows and is everlastingly exposed to the violence of terrible storms. After rounding the cape we go northwards for 1,200 miles along a rocky coast fringed with numerous islands, with narrow channels twisting in and out between steep cliffs. What island lies in latitude 42° S. ? From this point the line of cliffs continues almost without a break, though here and there there are a few small bays. Find

latitude 18° S. In what direction does the coast bend from this point? The mountains still keep near the sea. Note the position of **Cape Pariña**. This is the most westerly point of South America. What gulf lies north of Cape Pariña? What gulf lies south of the isthmus of Panama? The latter gulf is on a damp hot coast where tropical trees flourish in great abundance.

The Pacific coast of Central America is bordered by deep water, but it has few bays or headlands. In what country do you find the long narrow **Gulf of California**? What river runs into the gulf? About how long is the gulf? What peninsula bounds it on one side? What cape terminates this peninsula?

Farther north at San Francisco lies the deep inlet known as the "Golden Gate." What mountains bound the coast at this point? What cape is in latitude 40° W.? This is the most westerly point of the United States of America. Notice how the coast bends and how in all cases the bend is caused by the presence of mountain ranges. Name the ranges. What island is crossed by the parallel of latitude 50° N? What river runs into the sea here? From this point to a point 140° W., 60° N., there are 1,500 miles of scenery that very much resembles that of Norway, a collection of mountainous islands and narrow fjords. These islands keep the shore water calm, and so help to provide excellent salmon fishing. The west coast of the continent is much steeper than the east and the shore water is much deeper. The waters here are warmer than on the east because instead of being exposed to such a cold current as that which has rendered Labrador practically uninhabitable, they are heated by the Kuro Sivo coming from Japan.

Note the long finger-like peninsula at the south-west of Alaska. From here to the end of **Bering Strait** there is a series of bays that are icebound for the greater part of the year. The islands off the coast of Alaska are mainly volcanic.

North America has more coast in proportion to its size than any other continent except Europe. North America has two-thirds as much coast as Asia although it is only half as large. This is due to the number of peninsulas it

possesses, such as Yucatan, Florida, Nova Scotia, Labrador, Alaska and California.

South America is about twice as large as Europe but it has only four-fifths as much coast-line. This is due to the absence of peninsulas. No part of the coast of this continent is ever ice-bound.

REVISION EXERCISES

1. Give an account of the position and direction of (i) a cold water current, (ii) a warm water current, in the North Atlantic Ocean.

C. J., 1901.

2. Where are the following places and for what reasons are they respectively noteworthy: Cape Clear, Carnsore Point, Drogheda, Holyhead, Killarney, Limerick, the Lizard Point, Malin Head, Portrush, Spithead, Woolwich?

C. J., 1898.

3. On a map of South America insert the Andes, the Orinoco, the Rio de la Plata and its tributaries; the Pampas; Gulf of Darien; the frontiers of Chile, Ecuador, and Uruguay; the tropic of Capricorn; Rio de Janeiro, Callão, Georgetown, Quito, Iquique, Monte Video, Cartagena, Tierra del Fuego.

O. S., 1896.

4. Explain clearly, with examples, how ocean currents are created and modified by the wind. In particular, account for the production of the Peruvian and South Atlantic currents. In what parts of the world do those regions of calm known as doldrums or horse-latitudes occur? How are they produced?

C. S., 1888.

5. If the water were removed from the Atlantic Ocean, what deposits would you expect to find on the sea-bed in walking from Ireland to North America? Describe briefly the nature of the various deposits.

C. J., 1900.

CHAPTER XV

CLIMATE

If you will think for a moment, through how many degrees of latitude the twin continent extends, you will see that every possible variety of climate may be expected. Generally speaking, we may say that it is extremely cold in the far north and south and extremely hot in the tropical regions, but local conditions have always to be taken into account in estimating, from an examination of an ordinary map, what the climate is likely to be. The three main things to be

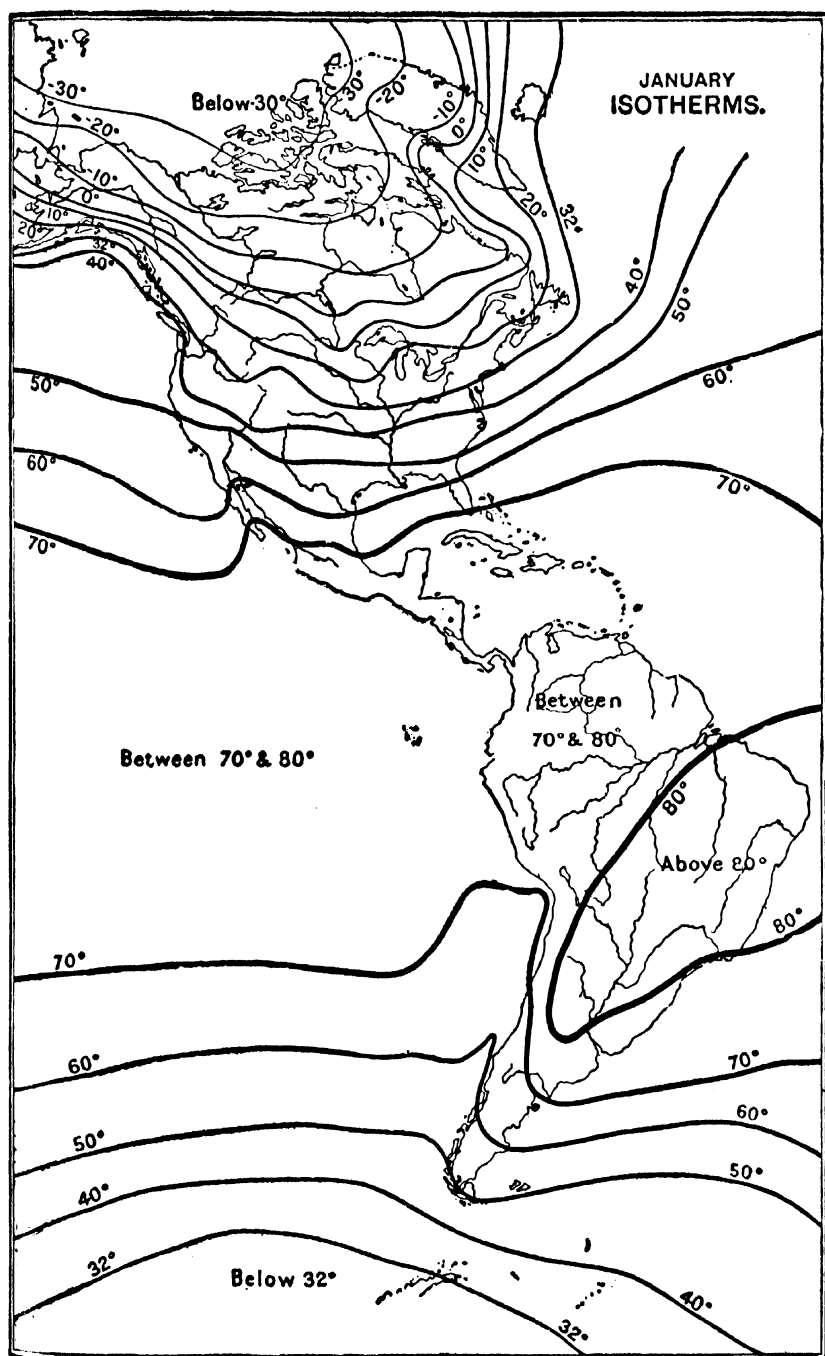


FIG. 35.—AMERICA : JANUARY ISOTHERMS.

considered are : (i) temperature, (ii) moisture, (iii) winds. And these things are affected by : (i) latitude, (ii) altitude, (iii) nearness to, or distance from the sea, (iv) direction of mountain ranges, (v) the character and direction of ocean currents and other less important causes.

Fig. 35 shows the January isotherms for America. In which directions do you travel from the equator in order to pass from warmer to colder places ? Speaking generally, what is the effect of latitude on the climate of each country ? Do the parallels of latitude and the isotherms coincide ? Where is the sun in January ? Where is the hottest region in January ? Land rapidly radiates away heat in winter, and rapidly absorbs it in summer. Water is both heated and cooled much more slowly than land. The interior of North America is therefore colder in January than places on the coast in the same latitude. How do the isotherms of North America illustrate this fact ? Note carefully the position of isotherm 32° F. (the freezing point of water). What places lie north of this isotherm ? What rivers, seas, lakes, etc., will be blocked with ice during the winter ? In the extreme north, and in the island of Greenland, snow lies all the year round. Winter in these parts is very severe and often lasts eight months out of the twelve. When the short, hot summer does come, it comes suddenly, with scarcely any spring.

Is there any part of South America with a temperature at or below 32° F. ? What is the temperature of the district lying on the equator ?

Fig. 36 shows the July isotherms for America. Where is the sun in July ? Compare the position of isotherm 50° in January and in July in North America. Do the same for isotherm 70° . Through how many degrees of latitude have these isotherms moved (a) over the land, (b) over the sea. (In all such questions, consider the lowest part of the curve only.) Make the same comparisons in the case of South America. Through how many degrees of latitude has isotherm 80° moved ? How far has isotherm 40° moved in South America ? Why should there be this difference ? What is the difference between the January and July temperatures of (a) Labrador, (b) Cape Horn ?

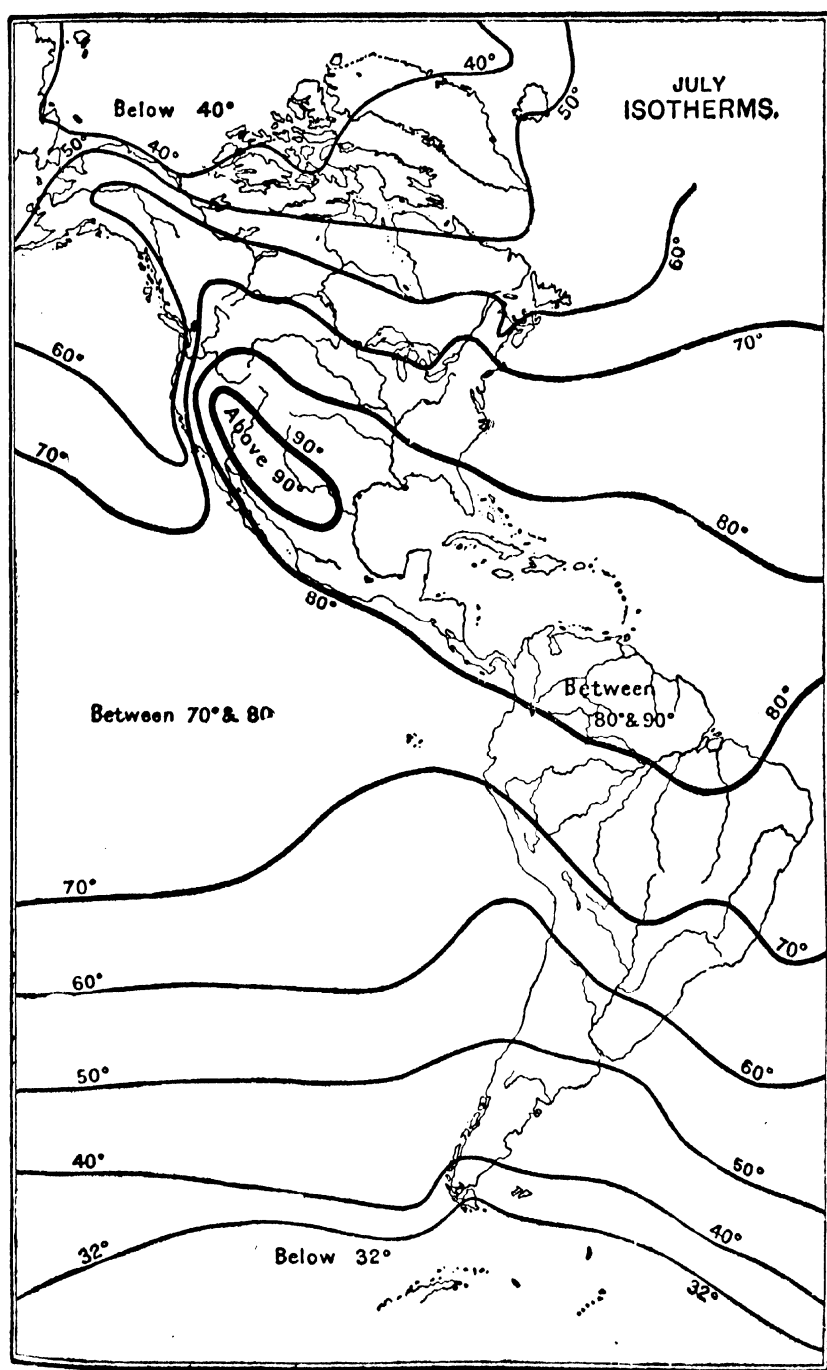


FIG. 36.—AMERICA : JULY ISOTHERMS.

A RATIONAL GEOGRAPHY

Explain why the difference is so great in one case and so little in the other.

From the maps given state the annual range of temperature in the following latitudes: (a) in the centre of the continent, (b) on the Atlantic coast.

Latitude.	Annual Range of Temperature.	
	(a) Inland.	(b) On Atlantic Coast.
70 ° N		
60 „		
50 „		
40 „		
30 „		
20 „		
10 „		
0		
10 ° S		
20 „		
30 „		
40 „		
50 „		

Fig. 37 shows (a) the January isobars. State in the case of each continent, (a) the position of the region of highest pressure, and (b) the position of the region of lowest temperature; (c) in what countries these regions lie. State what countries feel the effect of the North-east and South-east trade winds, and which feel the effects of the return trade winds.

Fig. 38 shows the July isobars. State for each continent the positions of (a) the region of highest temperature, (b) of lowest pressure. Do they coincide? If so, why? In the case of North America, which way do the winds blow, landwards or seawards? Are they dry or wet winds? If wet, where does the moisture fall?

Notice the positions of the areas where the rainfall is (a) small, (b) very great (*see* Figs. 37 and 38).

Make a list of these areas, and write opposite to them the amount of the rainfall, considering each period of six months separately.

AMERICA—CLIMATE

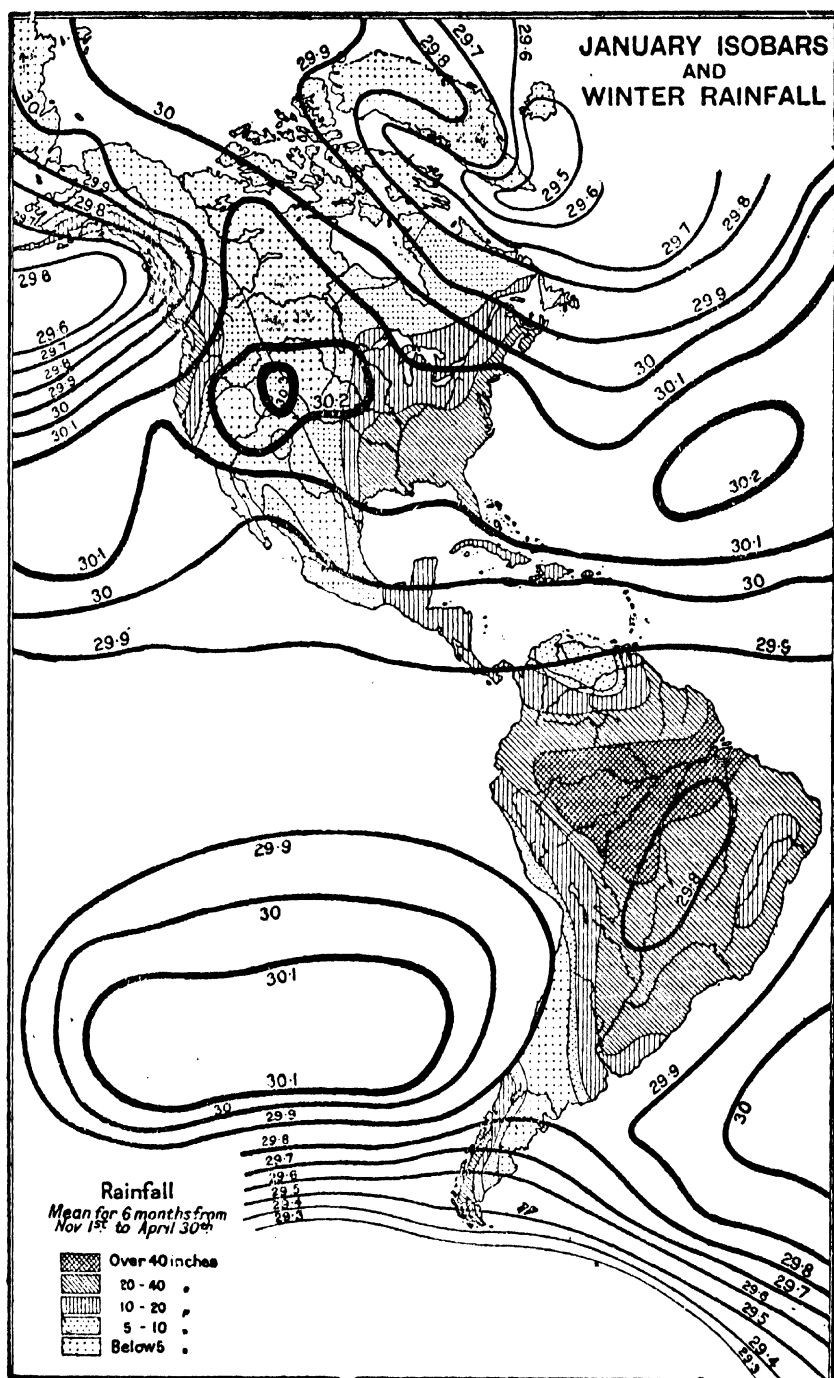


FIG. 37.—AMERICA : JANUARY ISOBARS AND WINTER RAINFALL.

In January, North America has dry, cold winds blowing from the land to the sea. When wet winds reach the land from the sea, the coast ranges condense the moisture, giving abundance of rain to the coast and little inland. The Rockies and the Andes are so high that the west winds get entirely robbed of their moisture in their passage across the mountains. The eastern mountain systems are lower, so that a certain amount of moisture passes from the east to the interior.

What river basin has the heaviest rainfall? This is the largest area of the heaviest rains in the world. Here it rains fairly continuously from January to May, but there is not so much rain during the rest of the year.

To sum up, we have heaviest rainfall on the east coast from Newfoundland southwards. This is moderate and steady and rather greater on the average than that of England. The rainfall diminishes from the coast to the interior.

At Vancouver is the centre of the region of the anti-trade winds; the annual rainfall is 60 inches. At Winnipeg, in the same latitude, but 1,100 miles inland, it is only 16 inches. British Columbia, with its heavy rainfall, has forests; Manitoba has none. The prairie region has less than 20 inches. West of the Mississippi little rain falls. The Sierra Nevada shuts off the rain from the Great Basin and converts it into a desert. Here farming is only possible where artificial irrigation is practised, for the annual rainfall is less than 10 inches. In the south of Mexico and in Central America there is always a fair supply of rain. The north-east trade winds give to Honduras and Nicaragua an annual rainfall of 80 inches. The south-west trade winds give an annual rainfall of 60 inches to the Pacific coast, where the mountains are nearest the sea. In the north-east there are no mountains to precipitate the moisture as rain, but the Arctic winds bring it down as snow. Winnipeg gets 60 inches of snow in a year. Farther north as much as 160 inches of snow will fall in a year. What do these figures represent in rain?

In the case of South America, the south-east trades give rain all the year round to the Brazilian Highlands from Cape St. Roque to the mouth of the La Plata, so that the eastern plains are well supplied with rain.

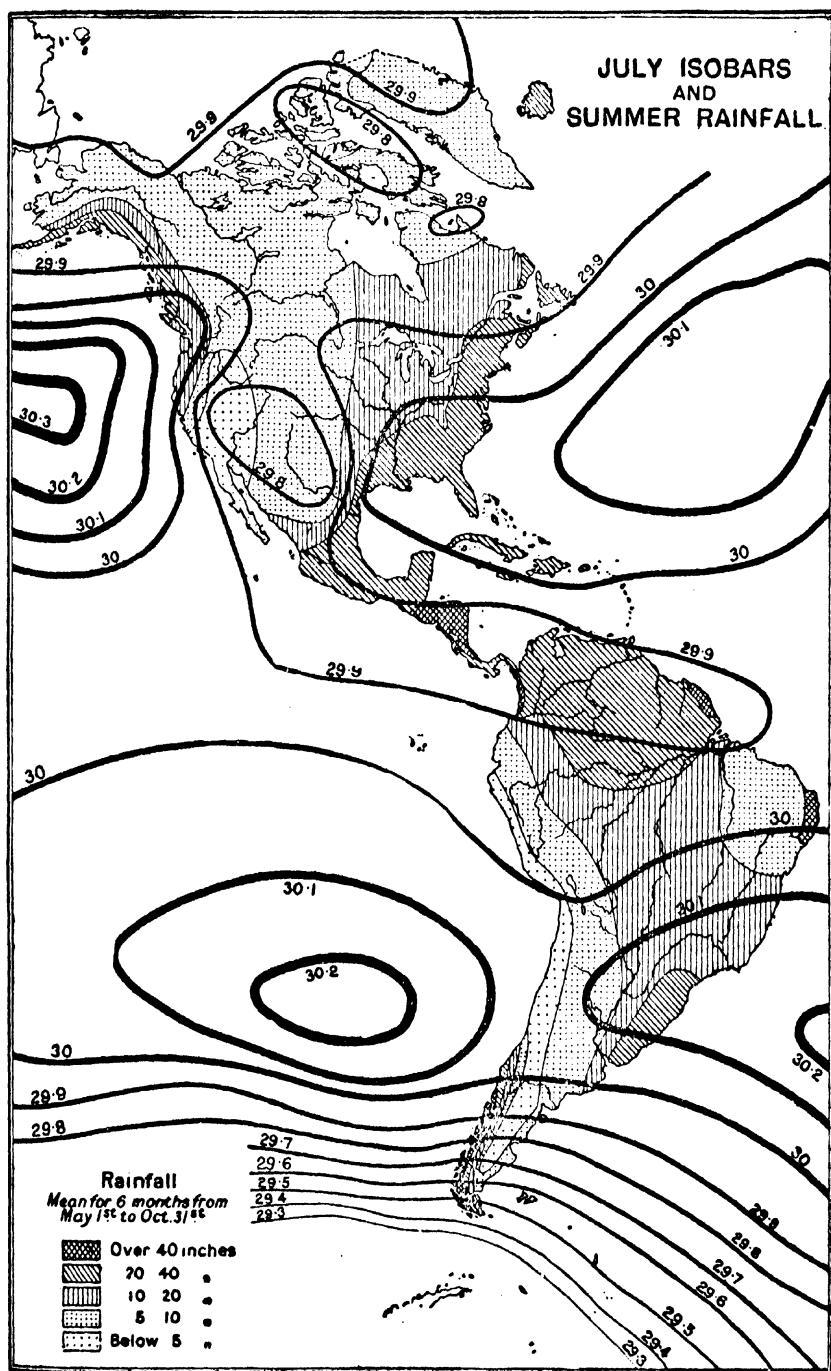


FIG. 38.—AMERICA: JULY ISOBARS AND SUMMER RAINFALL.

The Andes stop the wet west winds and keep the Pacific coast wet, but on the plateau round about Lake Titicaca there is a dry area corresponding to that of the Great Basin. The Roaring Forties blow steadily from the west across the cool and narrow part of the continent, but the Andes, here as elsewhere, deprive them of their moisture and so render the eastern parts much drier than they otherwise would be.

All places within the tropics have well-marked rainy seasons. When the sun is directly over a place, the ground gets heated to a high temperature, the air above this ground becomes less dense and rises and moist winds flow inland from the sea. These moist winds rise upwards and as soon as they reach a much cooler region of the atmosphere, their moisture is condensed and falls as rain. As the sun moves from one tropic to the other, the rainy belt follows it.

The maps show the influence of latitude, wind and rain ; but in a great continent there are always other things to be taken into consideration. Places near the poles have long days at one time of the year, and during these days they get a large amount of sunlight ; but when the winter comes the days are very short and the amount of sunlight is very small. This tends to make the climate one of extremes. At the Equator the day and the night are always equal, each being of twelve hours' duration. Sunlight is evenly distributed throughout the year. This tends to preserve an equable climate.

As the mountains run from north to south there is nothing to shut out the Arctic winds. They sometimes blow as far south as the Gulf of Mexico. This makes the winters everywhere much colder than they would be if the ranges ran from east to west. In the same way there is nothing to shut out the warm summer winds from the south. What will be the effect of this on the Arctic summer ?

In the winter America suffers from the blizzard. This is a cold wind from the north. When it blows the temperature frequently falls 30° F. below freezing point and a temperature of 62° F. below freezing point has been known. The gale travels at the rate of 30 to 50 miles an hour and drives before it, not snow, but small needles of ice. It has been known to last for 100 hours, blowing continuously with

a speed of 40 miles an hour. No one can live in these winds for any length of time, and people exposed to them have gone mad, from the irritating effect of the ice needles on the skin.

Currents. What is the effect of the Labrador current on Labrador? of the Gulf Stream on the east of the United States? of the Peruvian current on the south-east of South America? of the Kuro Sivo current on the north-west of North America?

Altitude. Find Orizaba, Popocatepetl, and Quito. On the map, showing the isotherms, these appear to be in a very hot region. The isotherms give the temperature at the sea-level. On the tops of the mountains there is really perpetual snow. At the foot of the mountains, bananas grow wild, but as the slopes are ascended you get fields of sugar canes, then fields of wheat and barley, then forests of deciduous trees, while higher still there are grasses and mosses, and finally the barren wastes of everlasting snow.

REVISION EXERCISES

1. Draw a map showing the distribution of atmospheric pressure and the direction of the wind in a cyclone over the British Isles. What kinds of weather would be experienced in different parts of the area covered by the cyclone? C. J., 1903.

2. Describe the chief ocean currents of the world, stating their directions, whether they are warm or cold, the causes which determine their flow, and how they affect the climates of (a) the British Isles, (b) Newfoundland, (c) Alaska. O. S., 1897.

3. (a) Describe the position of the mountains of South America, (b) state what parts of South America receive much and which very little rainfall. (Sketch maps may be used to answer (a) and (b). (c) What connexion is there between (a) and (b)? L. J. S., 1904.

4. Describe shortly the climate of Nova Scotia. Compare it with that of England, and give reasons for the differences you point out. O. J., 1906.

5. Describe the changes in climate and rainfall which would be observed in sailing from Panama to Monte Video through the Straits of Magellan C. J., 1888.

6. Fill in the third column in the following table:—

Place.	Mean Annual Temperature.	Latitude.
Rio de Janeiro	79° F.	
Cairo	72° F.	
Salonica	63° F.	
Marseilles	57° F.	
Paris	51° F.	
London	49° F.	
Moscow	40° F.	
Hammerfest	34° F.	
Melville Island	25° F.	

CHAPTER XVI

VEGETATION

THE character of the vegetation naturally varies very much over such an enormous expanse of country. It is influenced by temperature, rainfall, and the character of the soil.

In the most northerly and southerly districts of all, nothing grows. The island of Greenland and the islands off the north coast are buried in unbroken snow and ice.

Next we have the tundra district, characterized by mosses and dwarf trees. There is a short hot summer which is warm enough, but not long enough, to ripen grain.

On the edge of the tundra lie the forests, which are at first rather scanty and composed of stunted trees, but which, farther south, pass into magnificent forests of conifers. The pine woods are followed by an area of "mixed woods," which extend farther south along the coast than they do in the interior. Timber grows slowly and requires an abundance of moisture. Therefore, wherever it is warm enough and wet enough you may expect forests. Refer to the maps showing the rainfall and notice where the wet areas are. Those are the districts where the forests are to be found. The kind of forest varies with the latitude. In the most northerly they contain pines; and in the tropics they contain ebony, mahogany, etc.

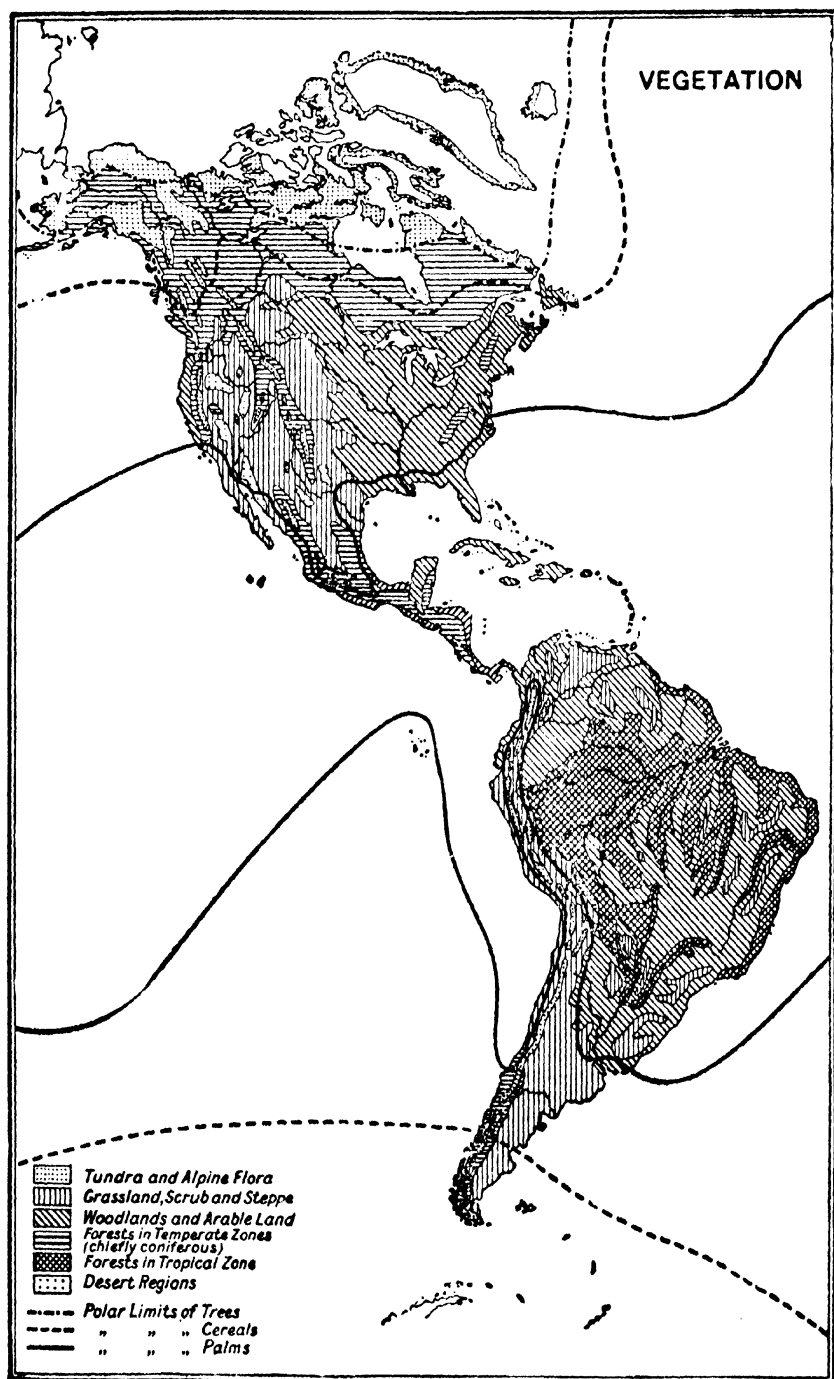


FIG. 39.—AMERICA : VEGETATION.

Shade or colour the forest areas on one or more maps. They are as follows:—

(i) An area bounded by Hudson Bay, Lake Winnipeg, Lake Superior and the other great lakes, and extending on the east from the Laurentian Mountains to Chesapeake Bay. The greater part of this area is occupied by various sections of the Dominion of Canada and timber is one of the most important Canadian exports. The Canadian forests cover almost the whole of Quebec from Ottawa to the river Saguenay. The numerous rivers are not only useful for transporting the logs, but also for driving the saw-mills. Ottawa has the largest saw-mills in North America. These mills are stopped in the winter because the rivers are frozen, but during that time the “hands” go “log-cutting” in the forests. The abundance of cheap water power in Newfoundland has led to the development of the pine forests. The north-east of New Brunswick is also covered with forests. The greatest export of timber is from New Brunswick and Quebec. The chief States in the United States that are engaged in the timber trade are Maine (chiefly spruce) Michigan, and Pennsylvania.

The moisture requisite for the growth of these extensive forests is supplied partly in the form of rain and partly in the form of snow. The snowfall in certain forest districts is a very heavy one, but this is a help rather than a drawback. The winter being long as well as severe, the snow hardens and forms excellent roads. During this season of the year, the trees are cut down. When the snow melts, the rivers get flooded and the logs of wood are floated easily and cheaply to the saw-mills. The “lumber” trade, as it is called, has been of immense service to the country, quite apart from the value of the timber. The “lumberers” cleared the land for the farmers who followed them, and they made roads and bridges which were afterwards used by the farmers when they found it necessary to transport the produce of their fields from one part of the country to another. The development of the lumber-trade began during the wars with Napoleon, when our trade with the Baltic was practically stopped, and we had to look elsewhere for timber supplies.

The chief **trees** of the northern forests are the **red** and **white pine**, and the **spruce**, which are evergreens,

and the **birch** and **maple**, which are deciduous trees. The maple not only supplies a very beautiful wood, but from its sap sugar is made.

(ii) A district in the west along the Pacific coast, between the mountains and the sea. This district extends from California right away beyond Vancouver Island. Here are felt the combined influences of the wet anti-trade winds and the warm Kuri Sivo current. In the southern latitudes some of the trees grow to an enormous height. The "giant trees" of California are quite familiar to us in pictures, views, and advertisements. The chief trees of the western forests are **pine**, **cypress**, and **cedar**. The forests on the island of Vancouver are the most important. The saw-mills associated with this industry are on the mainland.

(iii) Florida and the Bermudas (latitude 32° N.) have forests of the red "cedar wood" that is used in making lead-pencils.

(iv) In the plains of Mexico and Central America there are forests of trees that belong specially to tropical countries, such as mahogany, logwood, rosewood, and ebony. Examine the specimens of these woods in your school museum. These woods are called cabinet-woods or dyewoods, according to the purposes for which they are used.

(v) The region of heavy rainfall in South America has heat and rain in abundance, and the Amazon basin is one vast forest—the Selvas. Here grow all kinds of hard woods such as those mentioned in the preceding paragraph and other valuable trees such as india-rubber.

(vi) Brazil is almost covered with forests, and the valleys of the rivers are filled with rank jungle. The forests of the coast produce rosewood.

(vii) Paraguay and Uruguay. Both these States have supplies of hardwood and other timber trees. They are frequently flooded by the rivers that flow through them. The high land rising up to the mountains of Brazil is well wooded.

(viii) The West Indies, with the exception of the Bahamas, are all mountainous, but have low coastal plains. The soil, except in the coral isles of the Bahamas, is of volcanic origin, and as heat and moisture are everywhere abundant, the

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soil is fertile and the mountains are clothed with trees. Log wood grows everywhere. Mahogany is grown in Jamaica, Dominica, St. Lucia, and St. Vincent, but the finest mahogany in the world comes from Haiti.

Grass. The grass lands are the next most extensive areas of natural vegetation. Grass flourishes well in climates where there are great extremes, for it grows quickly, and a short hot summer suffices to bring the plant to maturity. Where there are forests there is little grass; where there is much grass there are few trees. Hence you can use the maps which you have just shaded to show the forest areas, for the purpose of showing the position of the grass-lands.

The coast provinces of the Dominion of Canada are all in latitudes suitable for grass and they have a sufficient supply of rain. Grass is therefore plentiful in Nova Scotia and Prince Edward Island; and along the dyked shores of the Bay of Fundy in New Brunswick. Shade the province of Alberta. Here there are plenty of streams and excellent grass-lands. The whole of the Great Central Plain of North America is either a grass or a grain district. The best grass-lands lie to the west of the Mississippi. Shade the area covered by the following States; Dakota, Minnesota, Iowa, Nebraska, Kansas, Missouri, New Mexico, Texas, Oklahoma, Arkansas. In this district there is not enough rain for forests, but there is enough for grass. Occasionally whole districts are devastated by fire, but the plant ashes that are left behind enrich the ground for another crop. The dryness of the climate makes it a healthy district to live in. Land is cheap and transport easy.

In Mexico and Central America there is no extensive area of grass-land except on the high plateau. In the cool higher regions where there is little forest growth, grass grows well.

We have already referred (*see* Chapter XII) to two of the great grass areas of South America, viz., the llanos of Venezuela that lie in the basin of the Orinoco, and the pampas that cover the surface of Argentina, and portions of Uruguay and of the south of Brazil. The climate of these latter districts is suitable for the growth of trees, but the rainfall is small, so that grass has taken their place. There is good grass on the high plateaus in most parts of the Andes.

Use another set of blank maps and insert the names of the following plants in the districts where they are grown. Maps showing the boundaries of the countries are most convenient.

Many different kinds of grain are grown on the prairie lands. The soil is richer than that of the grass-lands and the land is lower and warmer. The fertility of the prairie lands is wonderful. They suffer, however, from the absence of mountains to protect them from the summer frosts, caused partly by the inrush of cold winds from the north, and partly by the rapid radiation of heat from the soil in the night-time. The kind of grain grown depends on (a) heat and (b) moisture.

Oats and Barley are grown in Ontario, Prince Edward Island, in the crowded States along the Great Lakes, and in California.

Wheat requires a drier and a warmer climate than oats. It ripens rapidly and so can be grown in a climate suffering from extremes, provided that the heat be great enough during the short summer period. It is grown in Canada and in the prairie-land west of Winnipeg, especially in Manitoba and Saskatchewan. In the United States it grows in Washington, Oregon, Minnesota, Dakota, Ohio, and Indiana. The wheat from the last two States is chiefly exported from Chicago. Between the Sierra Nevada and the Coast Range there is a long narrow valley. Name the two rivers that water it. It is a region of dry heat, and in the low land, wheat of excellent quality is grown.

Maize is the only grain indigenous to the New World. All the other grains have been imported from the East. Maize requires more heat and more moisture than wheat. It is therefore grown farther south, in the States where there is an abundance of water. These are Iowa, Illinois, Missouri, Nebraska, Kansas. Name the rivers that provide the water supply.

Rice requires great moisture and heat. It is grown when the ground is actually under water, and large crops can therefore be obtained in the swamps of Louisiana.

[N.B.—It is not intended, in these and similar lessons, that you should learn the names of all the States given above,

They are merely given to enable you to mark the areas where the various plants, etc., are cultivated.]

Sugar Cane is grown for the manufacture of sugar. The canes are a species of grass with an abundance of sweet sap in the fibrous woody stem. When the canes are ripe they are cut down close at the base. The upper parts of the stems are replanted, but the lower parts are crushed in a mill and the juice extracted. The sap is subjected to a number of processes, the chief of which is evaporation. A part of the sugar crystallizes out and is sent as **raw** sugar to be refined. A part of the sap remains liquid and is called **molasses**. This is drained away and used in making rum. Sugar cane cannot be grown in cold or dry climates, as it requires both great heat and moisture. It is found on the low coast plains of Central America, and in the West Indian Islands. For some years the commercial importance of the sugar industry in the West Indies has been gradually declining. The owners of the plantations have lacked the necessary scientific knowledge and the plantations have deteriorated; white men cannot work in the plantations and black men will not work regularly or continuously; and to crown all, sugar is made from beet-root in France and Germany so cheaply that the cane sugar cannot command the sale it once did. There are signs, however, of the revival of a certain measure of prosperity.

In South America the cane flourishes in Uruguay, Paraguay, and British Guiana. The British colony has a narrow swampy coast belt where the heat is intense and the rainfall abundant. The predominant industry is the cultivation of the sugar-cane, and sugar is the chief export. One of the rivers, the Demerara, has given its name to a well-known kind of sugar. The colony possesses two ports: Georgetown, the capital, and New Amsterdam.

Cacao (or cocoa) is made from the seeds of a plant which is a native of the West Indies and of Tropical America. The fruit contains from 50 to 100 seeds. These are roasted and bruised and the skins removed. Then they are crushed between rollers. The tree has a long root and grows best on volcanic soil, near to the sea, but it must not be directly

exposed to the sea. It needs great heat and moisture and protection from hurricanes. These conditions are found in the West Indies, Central America, and parts of South America. The chief countries which produce cacao are Mexico, Guatemala, Martinique and other West Indian Islands, Ecuador, Peru, Bolivia and Venezuela. The best cacao in the world is grown in Venezuela. The largest export is from Trinidad.

Coffee is the seeds of a shrub, a native of Arabia and Abyssinia. The fruit resembles a cherry, and contains two of the seeds that we call coffee berries. There are two important kinds of coffee: (i) the Liberian, a lowland plant, which does best at a height of 1,000 to 1,200 feet; and (ii) the Arabian, which is a mountain plant and flourishes best at a height of 3,000 to 4,000 feet. The coffee plant has a long root and prefers to grow in rocky ground, especially when the holes between the rocks are filled with decayed vegetation. It needs great heat and moisture, but at the same time it requires protection from too heavy rains and from very strong winds. All these conditions are found, in the tropics, on the sides of forest clad mountains. As all the West Indian islands and many parts of Central and Southern America fulfil these conditions, there we may expect the coffee plant to thrive. It grows in Mexico, Guatemala, and Costa Rica. It is the chief export of Costa Rica (which is sometimes called the "Coffee Republic"), Puerto Rico, and Venezuela. The best coffee lands in Venezuela are round the capital, Caracas. Dutch Guiana has taken to growing coffee and cacao because her sugar has been unable to compete with that from British Guiana. Coffee is also grown in Peru, Brazil, Jamaica and Haiti. Haiti stands next to Brazil in the export of coffee, while the coffee grown on the slopes of the Blue Mountains in Jamaica has a deservedly high reputation.

Cotton. The cotton plant varies in size from a mere herb to a tree fifteen to twenty feet high. The fruit of the plant is a kind of pod containing from 10 to 30 seeds. These are surrounded by a white or yellowish down, which is **raw cotton**. The down is picked from the pod, cleaned from seeds, and then sent to the mills to be woven into cotton

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yarn and spun into cotton fabrics. The cotton plant requires great heat and moisture, so that the tropical regions of the world are well fitted for its cultivation. It is grown in all the States on the coast of North America from South Carolina to Texas. Name these States. There are two chief commercial varieties of cotton: (i) "sea-island" or long staple cotton, and (ii) "upland," or short staple cotton. Sea-island cotton is the best in the world. It flourishes in the low islands off Georgia, South Carolina, and Florida, where the effect of the warm, damp air is most felt. The short staple cotton, which is much less valuable but much more abundant, is grown on the low-lying land, south of the Mississippi.

Flax is grown in the State of Minnesota and in the Atlantic coastal plain, but its commercial value is much inferior to that of cotton.

Tobacco is the dried leaf of a plant which requires heat and moisture and a soil rich in lime and decayed vegetable matter. These conditions are best realized in several districts, between latitudes 50° N. and 50° S. On the mainland, tobacco is grown on the coastal plain from Chesapeake Bay southwards. The best pipe and cigarette tobacco grows in this area, especially in the high parts at the south-east of the Alleghany Mountains. The chief tobacco-growing States are Kentucky, Tennessee, Virginia, and North Carolina. In the West Indies the tobacco industry was a flourishing one for many years, but like sugar, it is gradually becoming of less and less importance. The finest cigar tobacco in the world comes from the West Indian islands. That grown in the neighbourhood of Havana in Cuba is the best, but the area is so small that it is absolutely certain that many of the "Havana" cigars sold in Europe could never have been grown in this district. Other islands that grow tobacco are Tobago, Trinidad and Porto Rico.

Drugs. The most important of these is cinchona, from the bark of which quinine is made. The plant requires a rich soil, and as this soil must be well drained, low-lying land is not suitable. It grows best on the sides of hills between 3,000 and 6,000 feet in height, and is a

characteristic product of the West Indies. It is cultivated in Jamaica, Dominica, Venezuela and Peru. From the latter country it gets the name of "Peruvian bark." The castor-oil plant produces a three-celled fruit, with a flat oval seed in each cell. The oil is obtained from these seeds by pressure, and is known as "cold-drawn" when extracted without the aid of heat. The plant grows well on waste lands, and in some places has flourished to such an extent that it has become a troublesome weed. It is found in the same districts as cinchona.

Spices. We can understand the presence of spices in all the West Indian islands if we remember that they all require heat, moisture, and a soil rich in decayed vegetable matter. There is one case, however, in which this is not quite true, for **pimento** will grow in very poor soil and so has found a suitable home on the stony north shore of Jamaica. The variety grown in Dominica is used for making "bay-rum." Pimento, which is also called "allspice," produces a fruit of a green colour. This is gathered when ripe, and dried. The dry red-brown fruit is the spice of commerce. **Nutmeg** grows best at a low level. The nutmeg bought in the shops is really the seed of the plant. It is surrounded by a brownish covering which is sold as **mace**. The best West Indian nutmegs come from Grenada. The **pepper** plant is a climbing shrub. The fruit is a small berry about as big as a pea. It is dried and ground to powder. It grows best in Guadeloupe. **Cardamom** is the seed of a plant, which requires shade and which must be grown at a fair height. The best West Indian product comes from Trinidad. **Ginger** is the dried root-like stem of an herbaceous plant. It needs a rich soil and is a valuable product of Jamaica.

Fruit. The kind of fruit grown varies with the latitude. **Apples** belong to the cooler northern latitudes. In the United States the best apples are grown in New York, Delaware, and Pennsylvania; but the finest apples in the world are grown in Nova Scotia. On the leeward side of the forest-clad hills there is shelter from fog and wind, and the hard winters kill the various parasites that usually injure the tree in milder latitudes. In the great cities of the United States,

an accessible and ready market is found for the fruit. Find that part of Ontario that lies between Lakes Huron, Erie and Ontario. This district is in the same latitude as the south of France. The presence of so much water preserves an equable climate and the soil is specially suited for fruit. Not only apples, but **peaches** and **grapes** are grown in this lake-surrounded area. The best **pears** are grown in California and in British Columbia. The climate of British Columbia is so good that even oranges will ripen, but the special product of the district is undoubtedly the pear.

Farther south are found the fruits that belong to warmer climates. In the Bermudas **melons** and **bananas** are grown in large quantities. These islands were once famous for **arrowroot**. Besides fruit, the Bermudas grow early vegetables for the New York market. Florida is the home of the **orange**. The tree has a long root and therefore requires a deep soil. When it has once taken firm root, it can withstand the force of even very severe storms. The peninsula is a sandy swamp, far enough south to be very warm and in such a position that it gets the full benefit of the Gulf Stream, but it suffers, like the other parts of the coast plain, from summer frosts which sometimes do considerable injury to the fruit growers. Oranges are also grown in Jamaica, Dominica, and the Bahamas; frosts are unknown in these islands.

Limes, from which "lime-juice" is made, come from Montserrat, Dominica, Jamaica and Trinidad. They will grow in the same soil as oranges, but reach a better condition if they are grown in valleys that are well wooded and sheltered from severe winds.

The **Banana** is the most widely distributed and the most nutritious of all tropical fruits, and forms an essential article of food to the native populations of the Torrid Zone. It is exported in millions from Jamaica, Martinique, Cuba, Dominica, Trinidad and Central America.

Pine-apples want lime in the soil, so that they grow best in coral islands like the Bahamas, or where there is limestone, as in Antigua. They are exported in large numbers from Jamaica to the United States.

Coco-nuts flourish on the coasts of Trinidad, Jamaica,

and the Cayman Islands. They will grow right down to the very edge of the sea and have served a most useful purpose in preventing the trade-winds from blowing the sand inland and smothering the interior.

Many good harbours on the coasts of the West Indian Islands have been blocked up with sand blown into them by these winds.

In South America, fruit is grown round Bogota on the plateau of Colombia, while Brazil has a characteristic product in its "Brazil nuts."

Vine. There are many vineyards in Ontario, Chile, Argentina, California. Californian wine is now well known in this country.

Rubber. India-rubber is used in the manufacture of the tyres of motor-cars and bicycles, mackintoshes and other waterproof articles, and tubing, and in the insulation of wires carrying electric currents. The plant is therefore an exceedingly valuable one. India-rubber (or caoutchouc) is made by collecting the sap of a certain kind of tree and then allowing it to congeal. Rubber is found in the forests on the coast of Ecuador, in the selvas of Bolivia and of Brazil, and in Paraguay.

Cassava is an important South American product. Its root contains an abundance of starch and a strong poisonous juice. The poison is removed by long washing, and the starch is granulated on hot plates. This granulated starch is **tapioca**. The root from which it is prepared is black outside and weighs from thirty to forty pounds.

Maté or Paraguay Tea is a beverage used throughout South America. It is prepared for the market by drying and roasting the leaves of a species of holly.

REVISION EXERCISES

1. By what causes are the vegetable productions of a country determined? Illustrate by reference to cocoa, coffee, copra, currants, india-rubber, sago, stating carefully what they are. O. S., 1893.

2. On a map of Ireland mark Macgillieuddy Reeks, the Slieve Bloom mountains, the rivers Suir and Liffey, Strangford Lough, and Galway Bay, and the towns Cork, Drogheda and Londonderry.

Show by shading, the district noted for growing flax and manufacturing linen. O. P., 1907

3. In what parts of North America are there (i) deserts, (ii) grass-lands, (iii) forests? Illustrate your answer if you can, by a sketch-map of the continent. What connexion is there between rainfall and the places where forests are found? L. J. S., 1905.

4. Compare the climatic conditions of the east and west coasts of South America from north to south, and indicate the influence of these conditions on vegetation. C. S., 1900.

5. Compare the vegetation of the Amazonian district of Brazil with that of Buenos Ayres. How do you account for the differences in either place? O. J., 1896.

6. What are the different zones of vegetation in North America east of the Rocky Mountains and between the Arctic Ocean and the Gulf of Mexico?

How far can they be explained by climatic conditions? Point out the chief natural products of each zone which are of economic importance.

(Supplementary Clerks Examination, Civil Service, September, 1907.)

CHAPTER XVII

ANIMALS

WRITE the names of the animals mentioned in this chapter on a series of blank maps, indicating the districts where they are found.

In the far north we have a region of fur-bearing animals. The winter is so long and so cold that the animals need a specially thick covering of fur to protect them from the severity of the weather. The most important fur-bearing animal is the seal. Seals resort in the summer to the Pribylof Islands and other parts of the coast of Alaska. At one time they were captured without regard to age or sex, and it seemed exceedingly probable that in time they would become extinct. Certain well-defined laws and regulations, however, were then made with regard to the taking of these animals, and the danger has been averted. The authorities whose business it is to see that the laws are enforced have their headquarters on Sitka Island. There is a certain amount of seal-fishing off Newfoundland, but the seals caught on this coast are taken only for their oil and skins, as their fur is of no value. The hunting season in Newfoundland lasts from the middle of November to the middle of June. The chief hunting grounds are the

ice-floes along the coast of Labrador. **Bears** and **elks** provide a certain amount of almost valueless fur, but the smaller fur-bearing animals such as the **marten**, **sable**, **silver-fox**, **beaver**, **mink** and **skunk** are of some importance. The home of most of these small creatures is in the marshland on the east of the river Mackenzie.

Sheep and Cattle have been introduced into both continents with great success. The sheep feed on the dry plains and hillsides, while the cattle are found in the lower, richer, and warmer areas. The whole of the Great Central Plain, west of the Mississippi from Alberta to the south, is covered with millions of sheep and cattle. Here are found all the conditions necessary to successful stock-rearing. The climate is good, grass and water are abundant, land is cheap, and transport is easy. Wherever there is grass-land in either continent, there do we find sheep and cattle, but some areas are more famous than others, either for the breed or the number of the animals reared. We propose to notice specially a few of the districts.

(i) Ontario. The soil is well watered and suitable for growing root crops, on which the cattle can be fed in the winter. There are so many cattle, that the making of **cheese** has become an important industry.

(ii) Alberta is a province nearly three times the size of the United Kingdom, and lies on or near the Rocky Mountains. The winters are not so severe as they are farther east, and the plains are clothed with sweet grass. Hundreds of thousands of horses and cattle are reared in the grass-lands, which here reach almost to the snows that crown the mountain-summits. At one time this was the home of the **bison**, which is sometimes, but wrongly, called a buffalo. The bison is a clumsy-looking animal, with a hump on its back and thick shaggy hair on the front of the body. It can move with great speed in spite of its clumsy build. The Indians depended on the bison for their maintenance. They used its hide to make clothes and to cover their wigwams. They ate the flesh, either fresh, or dried in long strips called pemmican. When the white man came, the bison were slaughtered in hundreds for the sake of their skins and they are now almost extinct. The place of the

bison has been taken by cattle and horses, which wander wherever they please over the wide and unenclosed plains. Each animal bears its owner's mark stamped on its flanks. The "cow-boys" who look after the cattle are splendid riders, and can throw a lasso of hide so as to single out and catch any particular animal that they wish to remove from the herd. The province of Alberta is so dry that much of the grass is turned into hay as it stands and the cattle can feed upon it all the winter through. They require no housing or artificial feeding as they do in eastern Canada.

(iii) In the United States, west of longitude 100° W., there is very little rain and farming does not pay, but from Montana to New Mexico and from Wyoming to Oregon there are plains covered with a coarse kind of grass, called "bunch grass" because it grows in clusters. On this millions of sheep and cattle are fed. There are many cattle round Lake Michigan, in Ohio, Indiana, Illinois and Wisconsin. The best wool comes from Oregon and California.

(iv) Mexico and Central America rear cattle on the high plateaus. Honduras, Colombia, and Ecuador all have a flourishing cattle trade.

(v) Argentina. The natural grass areas and the climate are both suitable for cattle. There is an abundance of water and Argentina does not suffer from drought like Australia.

(vi) Uruguay and Paraguay. The soil in these districts contains certain mineral substances that make the grass less fit for sheep than for cattle. Some of the towns connected with various branches of the cattle trade are world-famous. In Monte Video over a million cattle are slaughtered every year. At Paysandu tongues and "corned beef" are tinned. At Fray Bentos, Liebig's extract of beef is made.

(vii) Venezuela, the country of the Orinoco, the land of the wide park-like llanos, has thousands of cattle on its grassy plains.

Fish. The food fishes of the east and west coasts of North America are of great value. The most important

Canadian fisheries are those of **cod, herring, mackerel, lobster, salmon and seal**. Prince Edward Island has an abundant supply of lobsters, and Nova Scotia has so many men employed in the cod and lobster fisheries that fishing ranks next to farming as the most important industry of the colony. The centre of the Canadian fisheries is at Lunenburg, just south of Halifax, the capital of Nova Scotia. The harbours of both these places are always free from ice. In New Brunswick, too, the fisheries are of great importance. All along its eastern shores, lobsters are caught in vast numbers and there are many factories where the lobsters are canned for export. But the colony where the fishing industry is pre-eminently the industry is Newfoundland. The centre of the industry is the capital, St. John's, which is situated at the head of a fine land-locked harbour on the east side. It has been called the "fish-city," for most of the people are either occupied in catching fish, or cleaning fish, or curing fish, or making cod-liver oil. The fishing grounds are very extensive, as they embrace the coast of Newfoundland, 750 miles of the coast of Labrador, and the Great Banks.

The Great Banks are a big shoal formed by the combined action of icebergs and ocean currents. The icebergs that are brought south by the Labrador current have much *débris*, in the shape of stones and mud, frozen into them. When the warm Gulf Stream meets the icebergs it melts them, and they deposit all this *débris* in the sea. On the submarine plateau thus formed, more cod-fish are caught than in any other part of the world. From June to the middle of November there are always hundreds of boats engaged in catching, cleaning, and salting fish. The fish are finally taken ashore to be dried and exported. The fishermen who work on the Great Banks are known locally as "Bankers." **Salmon** are caught in the streams of the eastern maritime provinces, but they come chiefly from the west coast, from the cold clear rivers of British Columbia and Washington, particularly the Fraser and the Columbia. The centre of the industry in British Columbia is New Westminster. Most of the canned salmon sold in our shops comes from these parts of North America.

At certain seasons of the year "columns of salmon, miles long and many feet wide, moving like an army up the stream," can be seen. The salmon season lasts from April 1 to July 31, and during that time the Columbia River is crowded with boats. When the salmon are landed they are handled by Chinamen, who clean them and chop them up with remarkable rapidity. The canning factories extend all along the river banks, and together with the ugly stakes that hold the nets, completely spoil the scenery.

Oysters live in river estuaries where there is a certain proportion of fresh water and plenty of mud. They are plentiful in Chesapeake Bay. Name the rivers that flow into this bay. The peninsula of Delaware protects the beds from Atlantic storms. In South America oysters are common along the coasts, and in the warm shallow waters of the Gulf of Panama the pearl oyster is found. Most of the oysters eaten in Canada are obtained from beds on the coast of Prince Edward Island.

Turtles are plentiful in Jamaica and in the warm waters of the South American shores.

Wild Animals. We have already mentioned some of the wild animals of North America, such as the seal and the bison. There are many others, but few of them are of any use to mankind. In North America, in addition to those already mentioned, are the lynx, grizzly bear, musk ox, polar bear, walrus, moose, and Rocky Mountain goat. Try and get pictures of these and of those mentioned hereafter as belonging to South America.

In a continent like South America, where there are such extensive tracts of wet jungle, many terrible forms of reptiles, insects, and wild animals are found. Most of them are of little or no commercial value. They include the jaguar, puma, armadillo, ant-eater and rhea.

The llama is an animal about four feet in height, with a head and neck resembling that of the camel. It is found in flocks on the pampas, and is a valuable wool-producer. It is kept for its milk, flesh, and hide, and in the almost impassable parts of the Andes is used as a beast of burden.

The alpaca or dwarf llama, is another inhabitant of the pampas. Its wool is used in Europe for the manufacture

of certain kinds of cloth, one of which is known as "alpaca." Much, however, of the so-called alpaca is a mixture of silk and wool, woven to resemble the wool after which it is named.

REVISION EXERCISES

1. Describe the positions of the chief fishing grounds of the world, and state the geographical conditions which favour the fishing industries in these places. (N.B.—Consider only the fishing grounds of Europe and North America.) C. S., 1907.

2. Describe the positions of the chief English coal-fields which are *not* near the coast. To what special uses is the coal obtained from them put? O. J., 1906.

3. Draw a sketch-map of the great lakes which lie between Canada and the United States; naming them and marking the positions of Port Arthur, Hamilton, Kingston, Niagara, Toronto, Sault St. Marie.

C. S., 1895.

4. Make a list of each of the countries of North and South America and write opposite to them the names of the animals and fishes found in them.

5. (a) Name in order from north to south the states of South America bordering on the Pacific, with their capitals. (b) Describe the position of the Andes. (c) Where exactly are—Pernambuco, Tierra del Fuego, Cotopaxi, Monte Video, Demerara? O. J., 1892.

6. State what you know of the distribution and habits of the more important wild land animals of North America, noting particularly those which yield valuable articles of commerce. C. J., 1903.

CHAPTER XVIII

MINERALS

BOTH continents are rich in minerals, especially in gold and silver, the "precious metals." Minerals are found in hilly or mountainous districts, and not in flat alluvial plains, therefore we must look for them on the slopes of the plateaus that extend throughout the Cordilleras from Alaska to Cape Horn, and in the lower but older ranges of the east. Use blank maps. Shade the areas where coal is found and indicate the presence of other minerals in the districts where they occur either by writing their names or by letters of reference.

Coal and Iron are the most important minerals, as without them the great manufacturing industries could not exist. The coal in America is not widely distributed. It is confined to certain well defined districts.

In Canada the coal is not very much worked but there are three areas where it is to be found in abundance.

(i) Nova Scotia and Cape Breton Island. With the coal, good iron and excellent limestone (which is used in smelting iron) are found. The field is near the sea and within easy reach of the railways of Canada and the United States. The town of Sydney on Cape Breton Island has a magnificent harbour, and the Canadians hope that the coal and iron-field on which it stands will prove the richest in the world. It is only in recent years that the value of these mines has been understood. The Nova Scotia field in the north of the mainland sends its coal to the United States.

(ii) British Columbia. Coal is found on the mainland and on the neighbouring islands, but as there are no navigable rivers near the coalfields, it is only the island area that is well worked. Excellent coal comes from Queen Charlotte Island, but Vancouver has the advantage of being nearer the railways, and its coal commands the best price.

(iii) Alberta has a coalfield which covers an extensive area, but the coal is poor in quality. Calgary is connected by branch lines with the coalfields that lie round Edmonton and Lethbridge. Edmonton, besides mining coal, has one of the largest markets for raw furs in North America.

There are deposits of iron ore in Ontario, Quebec and British Columbia, but there are few iron works. The chief are at Nova Scotia; Hamilton, in Ontario; Montreal, in Quebec. Hamilton gets its coal supply from the United States. Across what lake will the coal be imported?

Round Lake Superior there is an extensive mineral field, which is especially rich in iron and copper, but it has not yet been completely explored.

The United States possess vast and practically inexhaustible deposits of coal and iron. The output of coal is greater than that of any other country in the world.

(iv) The Appalachian Field extends from the Gulf of St. Lawrence to Alabama, that is across the district of the

Atlantic Plain, a plain which, as we have already seen, is rich in vegetable products. The majority of the coal seams are horizontal and comparatively near the surface.

Pennsylvania is one of the richest mineral districts in the world, and produces one-half of the iron, nearly all the petroleum, and three-fourths of the coal mined in the States. It is the chief mining and the second manufacturing State in the Union. The centre of this coal and iron district is Pittsburg, which has an enormous trade in coal, iron and petroleum, and has the largest iron, steel, and glass works in America.

The Laurentian mineral field, with its rich stores of iron, extends south of Lake Superior into the State of Michigan. This State has no coal or limestone, but it has such an excellent system of water communication that these substances can be cheaply brought to the ironfields. The most useful iron deposits on the Appalachian field are along the Ohio, and in West Virginia.

(v) The Cordilleran coal and ironfield is in the plateau of the north-west states. The iron deposits are most worked near to Vancouver.

(vi) Mexico. Coal of inferior quality is found on the northern and western edges of the plateau, and is used on the Mexican railways. The iron, on the other hand, which is found on the slopes of the Sierra Madre is of the very finest quality.

Mineral Oil and Gas. Oil and gas are cleaner and cheaper than coal, and they are found in certain parts of the United States in such abundance that in some of the industries they have quite taken the place of coal. Canadian oil is found on the north shore of Lake Erie. The oil and the natural gas of the United States are found on the southern shores of Lake Erie. The States export more oil than any other country in the world. Ohio, which is a great corn growing and cattle rearing state, has underground stores of petroleum or rock-oil. The capital is Cincinnati. Cleveland, on Lake Erie, a port and a manufacturing city, has iron works and petroleum refineries. But the most famous state for petroleum is Pennsylvania. About fifty years ago petroleum was discovered and at once wells

were sunk in all directions. The oil flows out of the wells into tanks, and is carried away by iron pipes to the refineries and to other places. There are more than 4,000 miles of petroleum pipes in Pennsylvania alone. Philadelphia, fifty miles away, on the Delaware, is the chief manufacturing city in America. It is the largest coal market in the world and also ships the immense quantities of petroleum, brought to the port by pipes, hundreds of miles in length.

Gold and Silver. North America has valuable deposits both of gold and silver. The following are the chief areas of production :—

(i) Canada. Gold is found in the south of Nova Scotia, and gold and silver on the north shore of Lake Superior.

(ii) The basin of the river Yukon, in the district of Yukon, and in Alaska, contains much gold, but the metal is obtained under very great difficulties, due to the inhospitable climate. During the winter the thermometer registers -40° to -50° F. All the rivers are frozen from October till May and the ground is so hard that it often has to be thawed with fires before the gold-bearing earth can be dug up. This earth has to be washed in running water before the miner can tell whether he has any gold or not, and in order to get running water he has to wait for the short northern summer.

(iii) British Columbia. There are supplies of both gold and silver in the valley of the River Fraser. In the far-famed Cariboo district, millions of dollars worth of gold have been extracted and the supplies are by no means yet exhausted.

(iv) Silver is found right across the plateau from Montana and British Columbia to California, and gold is also to be obtained in many places. In this plateau the gold and the silver are obtained from veins in rocks deep under the ground. Very little of the gold is obtained from the sand and gravel of river beds. The richest gold mines are in Colorado. The richest silver mines are in Colorado and Montana, and produce nearly all the silver used in the world. Many of the mining camps are in the mountains far from the railways, and everything necessary for the work or life of the miners has to be carried by

donkeys over the steep and dangerous passes. Denver is the largest city on the plateau. In what state is it? Near what mountains? It was of little importance till the discovery of gold. In 1870 it had a population of 5,000. Thirty years later there were 132,000. To-day it has twelve different railway lines and distributes gold and silver all over the world.

California was another of the great gold-producing areas of the plateau. In 1847 the people were cattle raisers and the population was small. Then gold was found and in the next three years 90,000 people arrived. There was so much gold-dust to be found that men paid for the goods they bought, with handfuls of the "precious" metal. There were no police. Every man guarded his own property with his revolver, and the man who could shoot straightest ruled the camp.

(v) Mexico has supplies of gold and silver, of platinum, lead, copper, iron and mercury. The silver mines amongst the Sierra Madre were formerly the richest in the world.

(vi) Central America. There are valuable silver deposits in Honduras, and gold is found in several places; but as the country has not been thoroughly explored, little is known of the character or the extent of the mineral wealth.

(vii) The ancient rocks of the mountains in the east and north of South America are rich in gold and diamonds. Brazilian diamonds are well known.

(viii) The plateaus of the southern Cordilleras. The Spaniards, when they took Peru, about 350 years ago, found that it was a land of precious metals. They removed from the temples great heaps of gold that had been stored there, sometimes the loads being so heavy that it required forty-two horses at a time to move them. There was so much silver in the country that the Spaniards shod their horses with it. One of the great cities of those days was Cuzco, some of whose temples were plated with gold. Silver has been worked for hundreds of years in the wild upper ranges of Bolivia and Peru. The metal is carried slowly and with difficulty from the mountains to the coast by caravans of llamas. The famous silver mines of Potosi have been worked ever

since the days when Raleigh went to seek for Eldorado, and though they have produced over £600,000,000 worth of silver they are not yet exhausted. The capital of Bolivia is Sucre, which means "The Place of Gold."

Copper. Copper has become a very valuable metal, as it is used extensively in all branches of electrical engineering. More copper is found in America than in any other continent. It is worked—

(i) On the Laurentian mineral field, in Michigan and Ontario, and on the shores of Lakes Superior and Huron.

(ii) On the Cordilleran plateau at Montana and Arizona.

Nickel. The deposits of nickel in the neighbourhood of Ontario are the richest in the world.

Lead. The United States produces more lead than any other country in the world. The chief district for lead is in Colorado.

Sulphur is a volcanic product, and sulphur of great purity is found round the volcanoes of Mexico, especially in the crater of Popocatpetl.

Gypsum and **Asbestos** are found in Canada.

Salt, Saltpetre, etc. Salt is obtained in Turks and Caicos Islands in the West Indies. In Peru and Chile there are enormous quantities of nitrate of soda (Chile saltpetre). The deposit lies on the surface, and no mining is required. The workmen simply bore a deep hole about two feet wide into the ground. They then lower a small boy into the hole, and he arranges a fuse and a quantity of powder at the bottom. When everything is ready the boy is hauled up, the fuse is lighted, and the miners retire. When the charge explodes, the earth is cracked in all directions, and the nitre rock is simply dug out and sent to Antofagasta to be exported. It is used in Europe as a fertilizer for the fields.

REVISION EXERCISES

1. Illustrate by means of specific instances the statement that "Mountainous climates have a heavy rainfall." Point out, and account for, exceptions to it. O. J., 1899.

2. What are the chief towns connected with the Welsh coalfields, and what are their special industries? C. J., 1889.

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3. On the map of North America, mark the Cascade Mountains, the Gold Range, Mounts St. Elias and Whitney. Name the rivers Columbia, Nelson, and Ohio. Show the positions of Yellowstone Park, the Staked Plains, and the towns of Richmond, Seattle, St. Louis, Galveston, and Toronto. Trace the southern boundary between Canada and the United States; and indicate the chief regions in North America which produce (a) cotton, (b) iron, and (c) mineral oil. O. S., 1906.

4. State the most important regions where coal is found in North America. In the case of any one coalfield, state the uses to which the coal is put and the position of the chief centre where it is consumed or exported. L. J. S., 1906.

5. Which parts of America produce mahogany, sealskin, copper, silver, sugar, tobacco, petroleum, quinine respectively?

Describe briefly the climate and physical features of Mexico.

C. S., 1892.

CHAPTER XIX

DISTRIBUTION OF POPULATION—INDUSTRIES

EXAMINE the map, Fig. 40, showing the distribution of population in America. Where in North America is the population less than one per square mile? Is this district hot or cold, fertile or barren? Where is the population over sixty-four per square mile? Are these regions, on the whole, temperate or tropical? Are they grass-lands, forest-lands, or mineral areas? Notice in South America two well-marked areas where the population is less than one per square mile. What kind of vegetation covers these areas? Does excessive growth of tropical vegetation hinder or encourage a large population? Notice the few places in South America where the population is over sixty-four per square mile, and, if you can, account for these. In doing so, take into consideration the latitude, animal and vegetable, and mineral productions, etc.

Let us consider next the occupations of the people in the different parts of the continent. Answer the questions on population from your map.

What is the average population per square mile in the Tundra region? In Canada the Tundra region is called the Barren Lands. What does the name indicate? What



FIG 40.—AMERICA: DENSITY OF POPULATION.

kind of land lies north of the Tundra ? South ? The people dwelling in such a district have not much choice of occupation. They cannot farm, for it is too cold. With the exception of the reindeer, they cannot rear animals, for there is no grass on which the animals can be fed. During the summer, when the rivers and lakes are free from ice, the men engage in **fishing**, while the women are busy cleaning and drying the surplus supplies, for use in the winter, when no fish can be caught. During the winter the men are engaged in **hunting** small furred animals. The fur trade in these districts was once entirely in the hands of the Hudson Bay Company. They made rich profits by giving to the Indians blankets and knives in exchange for furs. The dwellers in the Tundra do not live in towns. They wander about seeking food for the reindeer, or hunting and fishing in different places, taking care not to stay too long in one place lest the supplies become exhausted. The people of the Tundra are nomads.

What is the average population per square mile in the area covered by the temperate forests ? Would you consider this a dense population ? There are not many possible occupations in a temperate forest. The chief are the **hunting** of fur-bearing animals, and **lumbering**, of which we have already spoken. The men who are engaged in catching the fur-bearing animals are called "trappers." The lumber trade has given rise to many other industries, such as the cutting of the logs into planks, the manufacture of paper pulp, etc. In the forests of Canada, **fishing** is an important industry, as the lakes and rivers are full of fish. The mines are becoming increasingly important, and every year more and more men are engaged in **mining**.

What is the average population per square mile on the grass lands of North America ? Of South America ? There are one or two areas where the population is very small. Why ? On the grass-lands **stock-raising** is the chief industry. This leads to a nomadic life, for the flocks and herds must move from place to place and the herdsmen must follow them. On the North American steppes, the men who own the ranches are chiefly white men, who have long

ago given up the wandering existence of the nomad, and now employ "cow-boys," to look after the cattle. The grasslands of South America, variously known as llanos, pampas, savanas, etc., have a very small population, but in the future they will be much more thickly peopled, as the soil and climate are suitable for the growth of large quantities of useful temperate and sub-tropical plants.

What is the average population per square mile in the tropical forests? Life is not easy in such regions. There are no roads, and a clearing once neglected is quickly overgrown. The few people who live in these forests are engaged in fishing in the rivers, collecting vegetable products, and in felling timber.

So far, we have said nothing about manufactures. In order that manufactures may be successfully carried on, many things are necessary. There must be either water power, or coal, or other fuel to drive machinery. There must be iron with which to make machinery. There must be plenty of raw material or else facility for getting it. It must be possible to distribute quickly and cheaply the finished product when it leaves the factory, either by rail, river, sea, or canal. The climate must be suitable for hard work, and food must be abundant and cheap. Now the densest population is on the eastern side of the continent, particularly in those states near the great lakes. But this is where the coal and iron exist, where other minerals are found, where there are excellent natural waterways, and where the land is fertile and the climate temperate. Raw cotton grows in the south, raw wool and hides come from the west. The sea is near at hand, and on the other side of the wide Atlantic are the great European markets. If you would realize how densely peopled this part of America is, look at Fig. 41, which shows the network of railways between Chicago and New York.

The United States is now a formidable competitor of England and Germany in the markets of the world. The principal manufacturing States are:—New York, Pennsylvania, Illinois, Massachusetts, Ohio, and New Jersey. The chief manufactures are those of agricultural implements, boots and shoes, carriages and wagons, railway and

street cars, cotton goods, flour, furniture, iron and steel, leather, lumber, paper and wood pulp, petroleum, silk, woollen and worsted. Agricultural implements, furniture,

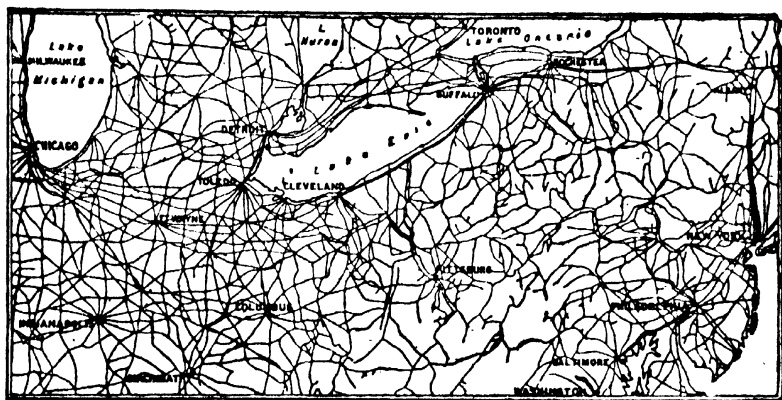


FIG. 41.—RAILWAYS BETWEEN CHICAGO AND NEW YORK.

wagons are made in the cities near the Great Lakes. Boots and shoes are made in East Massachusetts. Clothing is made in all the large cities, especially New York and Philadelphia. The chief cotton centres are in Massachusetts and Rhode Island, but many of the southern States are rapidly developing important cotton industries. Minneapolis is the chief flour-milling town. Pennsylvania stands first in the manufacture of iron and steel, but Ohio, Illinois and Alabama also have important iron works. New York is the chief publishing city. Meat-packing and slaughtering are large industries in Chicago, Illinois, Omaha, Nebraska, and Kansas City. The manufacture of woollen goods is mainly carried on in East Massachusetts, Rhode Island and Philadelphia.

The manufactures of Canada include ships, agricultural implements, leather goods and furniture. Sydney, in Nova Scotia, has large iron and steel works.

REVISION EXERCISES

1. The lowland plains of the temperate zones are the most favourable regions of the globe for the habitation of civilized man. State as many reasons as you can why this is the case. O. J., 1906.

2. Which are the most important towns engaged in ship-building in the British Isles ? What is the cause of our success in this occupation ?

O. J., 1899.

3. Show by means of a map what are the main geographical features and political divisions of British North America.

O. S., 1896.

4. Where are forests found in South America ? Give reasons for this distribution.

L. J. S., 1907.

5. What are the chief industries carried on in New England ? In which States are they carried on ? Name some of the chief industrial towns.

O. J., 1907.

CHAPTER XX

COMMERCE—PORTS

1. The Dominion of Canada

CANADA, like all other new countries, exports raw materials, the produce of her forests, fields, mines and waters, and she receives in exchange manufactured articles of many kinds. Most of the trade of Canada is carried on from the east coast, because this faces the European markets, while the western ports face such places as Japan and China, countries that are in no need of Canadian produce. The northern coast is valueless for commercial purposes, as it is blocked with ice. The eastern coast, from Nova Scotia northwards, is similarly rendered useless during the winter. Most of the Canadian rivers run north and south, and so are of little or no service as outlets to the sea. There is some compensation in the fact that the country is only 2,700 miles from Europe, that it has railway communication from coast to coast, and that the land boundary with the United States is merely an artificial one which offers no barrier to the interchange of goods.

The principal exports of Canada are timber, cheese, gold-bearing quartz, wheat, bacon, cattle, butter, flour, copper, coal, fruits, lobsters, cod, hides and skins, furs, leather, and salmon. The chief imports are iron goods, coal, woollen goods, sugar, cotton goods, tea, oils, tobacco and paper.

Insert all the ports mentioned in this chapter on blank maps. Rule a page in your notebook as shown below. The information required to fill up the several columns can be obtained from an A B C Railway Guide, or from a British and Foreign Steamship Guide. Maps showing the courses taken by the steamers can be obtained from the various shipping companies.

Port.	Sail from what Port in the British Islands.	Line of Steamers.	Length of Voyage.	1st Class Fare.

Halifax. On what peninsula? The harbour is large and deep, easily accessible to the largest vessels, and is never frozen over. The town is unfortunately far removed from the Canadian centres of population, and much of the trade of Montreal and Quebec passes through New York and Boston. It is the chief British naval station, and is garrisoned by Canadian troops.

St. John (New Brunswick) trades largely in timber, and at one time was famous for the building of wooden ships. Its harbour is not particularly good, and the high tides of the Bay of Fundy are a hindrance to navigation.

Port Nelson, or Fort York, is on Hudson Bay. At the mouth of what river does it stand? What happens to the harbour in winter? If it were not blocked by ice for so many months it would be an exceedingly important place, for the shortest route from the wheat fields of North America to Europe would be from here, via Hudson Strait. A railway is now being made to connect the town with Winnipeg. A recent report made for the Canadian Government states that with the aid of ice-breakers there is a possibility that the harbour might be kept open throughout the greater part of the year.

Montreal, the largest city in Canada, is a "river-port."

On what river is it? In what province? In the winter the river is frozen, but in the summer ocean steamers can reach the city, as the river channel has been artificially deepened. Montreal stands at the junction of three canal systems, the St. Lawrence, the Ottawa, and Lake Champlain, and at the junction of three railways, the Inter-Colonial, the Canadian Pacific, and the Grand Trunk. It is situated on an island, but is connected with both shores by large and handsome bridges. It exports the produce of Ontario, the richest and the most densely peopled part of the Dominion. These exports are grain, flour, cheese and timber.

Quebec was at one time the head of navigation, but since the deepening of the channel has allowed steamers to reach Montreal it has somewhat declined in importance. It is a picturesque city with steep winding streets, and quaint old houses. It has fine Parliament and university buildings. On the heights of Abraham which crown the north bank of the St. Lawrence, Wolfe met his death. There is an abundance of pasture and timber in the province. Cattle are reared in large numbers, and their hides are tanned with the bark obtained in the forests. There is therefore a flourishing leather trade.

Ottawa is the centre of the Ontario lumber trade, and its sawmills are the largest in Canada. It is the Federal Capital and Seat of the Dominion Parliament.

Toronto. On what lake? It is in the midst of a thickly peopled district, and is a great railway centre. It is the capital of Ontario, and contains the Parliament buildings and a university. The climate is mild and the soil is fertile, so that Toronto has become an important agricultural centre. Reaping machines are made in large numbers and exported all over the world.

Hamilton. On what lake? Much fruit is grown, and the port has rail and canal communication in many directions. What do you infer from the fact that this town is sometimes called "The Birmingham of Canada"?

Kingston. On what lake?

Vancouver, one of the termini of the Canadian Pacific Railway, is on the Pacific coast. Its trade is chiefly transit

trade between Europe and the East via Canada. The peninsula on which the town is built is washed on three sides by salt water. There is regular steamship communication with Australia, China and Japan.

Esquimault, the port of Victoria, is sheltered from gales, has a fine climate, and deals with the coal trade of the western coast, the salmon and gold industries of British Columbia, and the fur trade of the north. It is a British naval station. On what island does Esquimault stand ?

2. The United States

The United States are favourably situated for commerce. On the Atlantic side they are within a few days' sail of the chief ports of Europe, and they possess good harbours that are free from ice during the winter. On the Pacific side they have easy access to Japan, China, India and Australia. The commerce of the United States is increasing so rapidly that the country must soon become the foremost commercial nation in the world. The chief exports are cotton and cotton goods ; wheat, flour, maize, meat and dairy products ; mineral oils ; tobacco and cigars ; timber ; iron, steel and copper ; cattle and leather. The leading imports are sugar, wool and woollen goods, coffee, raw silk and silk goods, chemicals, iron and steel, flax, hemp and jute, cotton goods and yarn, hides and furs, fruits, tea and india-rubber.

New York. Near the mouth of what river ? What island lies to the east ? Is New York conveniently situated for European trade ? Are there coalfields and manufacturing centres within easy reach ? New York has river, rail and canal connexion in all directions. It has an enormous population, and the chief local industry is the manufacture of clothing. Land is very dear, and consequently the buildings are raised to a great height. "Sky-scrapers" of twenty-five stories are quite common. New York is one of the busiest and noisiest cities on earth, but possesses quiet quarters, such as its great park and its

handsome residential streets, where the homes of the wealthy merchants are situated.

Boston. In what State? This is the oldest of the large cities and the second port in the country. It has a good harbour but has no coal or iron. Note the distance from Montreal and you will understand why goods for Montreal are often sent via Boston, rather than via Halifax. Boston has plenty of water and is near great forests. The trees of the forests supply wood for the manufacture of paper, and bark for tanning leather. From the leather, boots and shoes are made. In the city there are a number of fine buildings and the people boast that they are the best educated in the United States. Note how the railways radiate in all directions.

Philadelphia. In what state? On what estuary? The harbour is sometimes partly frozen in winter owing to the fact that it is surrounded by masses of land. The importance of Philadelphia is due to its nearness to the great coalfield. What hills appear at first sight to shut it off from the coal and ironfield round Pittsburg? There is, however, a gap in the ridge, through which the Susquehanna flows, and through this gap the railway runs that connects Philadelphia with Pittsburg. Philadelphia is the greatest manufacturing and brewing town in America. The neighbouring forests supply bark for tanning leather. There is a large export of wool and skins, as the port is in a splendid sheep-rearing district. Shipbuilding is an important industry. What is wanted for the building of ships? Whence does Philadelphia get this material?

Baltimore. On what bay? In what State? In the Hinterland fruit and tobacco are grown, and in the shore waters some of the finest oysters are obtained. The chief industries are the tinning of fruit, vegetables, and oysters, and the manufacture of tobacco.

Portland is in Maine, the "Pine tree" State, and has a large timber trade, and manufactures of paper-pulp, paper, and leather. It is the terminus of the Grand Trunk Railway of Canada, and the winter port of the St. Lawrence valley.

New Orleans. On what river? In what State? From

the Mississippi Valley New Orleans collects sugar, molasses, rice, tobacco, maize, wheat, oats, flour and cotton for export. It is the largest cotton market and cotton port in America, but is unfortunate in being built upon an unhealthy swamp. Coal and iron are wanting, and the mouth of the river needs constant dredging. There are several other "cotton" ports, such as Charleston, Savannah, Mobile and Galveston. Find them on the map, and say in what States they are situated.

Chicago is one of the many "great lake" ports. In what State? On what lake? In 1830 there were twelve cottages here. In 1871 there were 25,000 houses. The whole place was then swept away by fire, but in less than forty years it has been rebuilt, and now contains nearly two million inhabitants. What is there to account for this almost miraculous growth? In the first place Chicago has excellent docks and plenty of deep water. Vessels of 5,000 tons can load and unload at the quays. It is the natural meeting point for most of the great railways that run from one side of the continent to the other, and which cannot cross Lake Michigan direct. It lies in an area which produces enormous supplies of grain, pigs, lumber, and cattle. It makes leather, iron and steel rails, and locomotives. Whence does it get its coal and iron?

Cleveland. On what lake? The chief trade of this port is in coal, iron and petroleum.

Buffalo. On what lake? Buffalo is the third grain port on the Great Lakes, and has a large coal and iron trade.

Detroit is another of the "lake" ports.

Milwaukee is famous for its beer, and is one of the greatest wheat and lumber ports in the world.

St. Louis. At the confluence of what two rivers? Is this a good position, and if so, why? Grain is grown in the north-west, and the climate being dry, flour is made. St. Louis manufactures tobacco from the leaf grown in the south-east, and is so situated that it can collect many varieties of goods from a wide and fruitful area. It stands at the lowest point where, in earlier days, the Mississippi could be bridged, and so became a great railway centre.

San Francisco. In what State? San Francisco has a

splendid climate, and lies on the edge of an area rich in wheat, fruit, wood, gold, and silver, but unfortunately has no coal. It is the point where the railways meet in order to reach the Pacific. The harbour is the only natural one in nearly 1,500 miles of coast, and this harbour is not a mere indentation but almost an inland sea. The city was almost destroyed by fire and earthquake in 1906, but is being rapidly rebuilt with all that wonderful energy and resource for which the Americans are so noted.

Portland (Oregon) trades in wheat and salmon from Columbia, and timber from the Cascade Mountains. **Seattle** (Washington) is another rising port on the Pacific.

3. Mexico and Central America

This area is marvellously endowed with an abundant and valuable supply of natural produce, but the people are lazy and wanting in enterprise. The exports are the products of the forests and the mines. The Canal Zone, five miles on either side of the Panama Canal, is United States territory; but the vast traffic passing through the new route opened by the Canal will greatly increase the importance of the adjoining seaports.

Vera Cruz. On what gulf? In what State? The Hinterland is the most densely peopled part of the country but the climate is terrible. "It is simply a filthy fever-haunted gateway to the plateau."

Acapulco has a fine natural harbour. On what meridian does it stand? It has a better climate than Vera Cruz, but the high mountains render access to the interior almost impossible.

In January, 1907, a new railway was opened across the Mexican isthmus of Tehuantepec, connecting the Atlantic port of Puerto Mexico (Coatzacoalcos) with Salina Cruz on the Pacific.

4. The West Indies

The trade of the West Indies is mostly with Great Britain and the United States. The islands export sugar, rum,

coffee, fruit, asphalt, dyewoods, dyes, limejuice and spices. They import cotton goods, haberdashery, hardware, food products such as rice.

Kingston, the capital of Jamaica, has a fine harbour, and is sheltered by the Blue Mountains.

Havana (Cuba) has a splendid "haven." It is the most westerly harbour in the West Indies, commands the entrance to the Gulf of Mexico, and is the natural centre for the sugar and tobacco industries of the islands.

5. South America

South America has rich stores of minerals, but they have never been energetically developed. The various States export nothing but raw material, and get all their manufactured goods in exchange.

Cartagena. In what country? On what sea? The exports are coffee, cacao, ivory, nuts, and dyewoods.

Guayaquil, three days' steamer journey from Panama, is the chief seaport of Ecuador. It is situated in one of the earthquake regions, and most of the houses are built of bamboos, bound together with leather thongs, and plastered over with mud. The estuary of the river forms an excellent harbour. The town is in a very unhealthy situation, for the low area on which it is built is constantly flooded in the rainy season. Cacao is grown on the surrounding hills.

Callão is the port for Lima, the capital of Peru. The harbour is excellent, but the town is neither beautiful nor clean.

Valparaiso in Chile, the most important commercial centre on the west coast of South America, possesses a well sheltered harbour. On April 18, 1906, Valparaiso suffered from a severe earthquake, when about 3,000 persons lost their lives and about 100,000 were rendered temporarily homeless. The shocks lasted only for a few minutes, but every town and village within 100 miles of Valparaiso was reduced to ruins.

Buenos Ayres ("Good Air") is the capital of the

Argentine Republic, and the largest and most important city in the southern hemisphere. On what estuary does it stand? The shores of this estuary are low, and much money has been spent in making a good harbour.

Monte Video, the capital of Uruguay, stands on gently-rising ground. On what estuary? Monte Video is the best built city in South America, and enjoys the most healthy climate. The chief exports from this port are cattle, hides, preserved meats, wool and tallow.

Rio de Janeiro, the capital of Brazil, is known as the "Queen of the South." The streets of the city are so narrow in many places, that carriages are forbidden to pass along them. The houses are often carved and coloured in a picturesque fashion. The quays are covered with cargoes of coffee, for half the coffee grown in Brazil is exported from Rio. The harbour is everywhere at least sixty feet deep, and is surrounded by hills that afford it shelter and protection.

Bahia is the second city in Brazil, and has a large foreign trade.

Georgetown. On what river? The capital of what colony? The chief exports are sugar, rum, molasses and gold.

REVISION EXERCISES

1. What is meant by the latitude of a place? Give an account of a simple way of finding the latitude of your school (a) on March 21 if it is sunny, and (b) on any clear night. L. J. S., 1906.

2. Draw a map to show the hills, plains, rivers, chief towns and villages and the most important railways within ten miles or so of your school.

L. J. S., 1906.

3. Draw a sketch map of North America showing the lowlands, the deserts and four of the chief rivers with their names. L. J. S., 1907.

4. Name and state the position of five of the chief ports of the east coast of the United States and Canada and note from what region each derives the principal goods which it exports. L. J. S., 1906.

5. Name the chief West Indian islands. What do they import?

C. J., 1900.

6. What are the Rocky Mountains? What British province is west of this range? Name its islands and ports, and state briefly what you know of them.

C. J., 1889.

CHAPTER XXI

RAILWAYS

THE main lines of railway in North America run east and west, from one side of the continent to the other, with important branches in all directions in the thickly populated area. In the Old World the railways have come to the towns, but in the New World the towns have come to the railways, and whenever a new railway is opened in a fertile, or otherwise productive district, towns are sure to spring up along its route. Take a map of America and insert each railway mentioned. The best way to do this is to insert in a blank map, all the towns given, and then join them one to the other, or else to use a map with the names already given and draw thick ink lines to mark the railway routes.

The Canadian Pacific Railway (C.P.R.).¹

Quebec, the capital of the province, and formerly capital of Canada. On what river? Quebec is the seat of a very large timber trade.

Montreal, the largest, and the chief commercial city in Canada. In what province? On what river?

Ottawa. In what province? On what river? It is the capital of the Dominion of Canada and the centre of a great lumber trade. What canal connects it with the lakes?

The railway line now runs right across the country to **Sudbury**, in the centre of the district from which the supplies of copper and nickel are obtained. It next skirts Lake Superior and presently arrives at Port Arthur.

Port Arthur is an important lake and railway junction, and commands the Winnipeg grain trade from the north-west corner of Lake Superior.

After leaving Port Arthur the line runs through country

¹ A limited number of sets of Lantern Slides are lent out by the C.P.R., illustrating either Canadian scenery or Canadian farm life. Specimen lecture sent *free* with the slides. An experienced lecturer will also be sent *without charge*. Apply Lantern Slide Dept., C.P.R., 62-65, Charing Cross, London, S.W.

mostly low and swampy and covered with timber, to Winnipeg.

Winnipeg, the capital of Manitoba, is at the confluence of two navigable rivers. Name them. It is a great railway centre, the C.P.R. being here joined by eight other main lines or branches. The town forms a collecting and distributing centre for the forests, the grain lands, the prairies, and the fur lands of the surrounding regions. Thirty years ago there were only 300 people living here. To-day there is a large town with handsome buildings, and possessing everything that a modern town needs or desires.

The railway runs west through the province of Manitoba. This province has a rainfall of only 16 inches, not enough for trees, but enough for corn. The province is as large as Great Britain and there are millions of acres of fertile land waiting to be ploughed. It has been called the "Peasant's Paradise." Here one finds fresh air, no smoky chimneys, abundance of pasture land, cornfields, streams and lakes full of fish, and one of the healthiest climates in the world. On the main line of the railway there are stations about every seven or eight miles, so that the produce of the fields can be easily transported to the markets.

After leaving Manitoba, the line runs through the provinces of Saskatchewan and Alberta.

Regina is the old capital of the North-West Territory and the new capital of the recently formed province of Saskatchewan, but it is only a tiny place. It stands at the junction of the two great areas where cattle are reared and grain is grown.

Calgary is situated within reach of the grass-lands of Alberta and the coalfields. What river does the line cross between Regina and Calgary? What town stands where the line crosses? At Calgary the ascent of the Rocky Mountains is commenced. The railway follows the Bow River, and at Kicking Horse Pass, 5,300 feet above the sea, it reaches its highest point. Thence it descends the western slopes of the Rockies, ascends and descends certain other lower ranges, and then finally gets down to the low land by means of the valleys of the Thompson and Fraser Rivers. What town is at the terminus?

The C.P.R. provides the shortest route from England to New Zealand and China. The journey to Sydney in Australia, via Brindisi and the Suez Canal, takes a little less time than that via Canada, but the latter route has the advantage of being entirely in British territory.

The Grand Trunk Railway. Portland (Maine) is the largest city in the "Pine Tree State," the terminus of the G.T.R., and the winter port for the St. Lawrence Valley.

Montreal. The line crosses the St. Lawrence to get to Montreal by means of the Victoria Bridge. It follows the banks of the river and reaches Kingston.

Kingston. What canal runs hence to Ottawa? On what lake is Kingston? It is an important trading centre and fortified town.

Toronto. On what lake? Toronto is the largest city of Upper Canada, and the capital of the province of Ontario. It is the "Queen City of the West," has great shipping interests on the lakes, and is the chief centre of the industries and trade of the province.

Hamilton. At the west end of what lake? Large quantities of fruit are grown in the rich agricultural district (the "Garden of Canada") in which Hamilton stands.

Detroit.

Chicago.

Numerous branches, under different names, leave this line at various points to connect the towns of Quebec and Ontario with many of the largest towns in the United States of America.

The Northern Pacific.

Chicago.

Duluth (Lake Superior) is a rapidly growing town and is the furthest port inland. It is the real terminus of the N.P.R. but sends a branch through Minneapolis to Chicago, and in this way is linked to the eastern towns. It commands all the wheat and iron trade of the central part of Minnesota.

The Northern Pacific Railway runs through the "Granary of the United States." Mile after mile of waving cornfields

are to be seen, divided from one another, not by hedges but by barbed wire. Most of the work on the farms, from the ploughing of the ground to the threshing of the crops, is done by machinery, for the areas reaped are too great to be worked with horses. There is one wheat field in Dakota that is 45 miles long. So flat are the plains, both here and farther south, that in taking a railway line across the Central Plain it is rarely necessary to make either embankments or cuttings. The line crosses the Missouri at **Bismark** and then begins its ascent of the Rockies by means of the valley of the Yellowstone River. What State does it cross to arrive at the Rockies? It descends chiefly by the valley of the Snake River.

Portland (Oregon). The State of Oregon is famous for its lumber, chiefly of a fir known as the Oregon pine. Portland exports timber, wheat, flour and salmon.

From Portland one branch line runs north to Puget Sound while another runs south to San Francisco. What river valley does this latter branch run in, south of latitude 40° N.?

The Union and Central Pacific Railways.

The Union Pacific Railway crosses the continent from Chicago to Ogden, where it joins the Central Pacific Railway, which runs thence to Oakland, opposite San Francisco.

Chicago. In what State? On what lake? It is the greatest grain and provision market in the world, and the second city in the United States.

Omaha stands at the junction of the Missouri and the Platte. From this point the railway begins its ascent by means of the valley of the Platte. Omaha is in the maize area, and hence rears pigs, and has a large cattle market. It has also important iron works.

Ogden. Railway junction.

Salt Lake City stands in the midst of thriving farms and prosperous villages, in a region that was once desert, but that has now been rendered fruitful by the construction of irrigation works.

The line next runs across the deserts of Utah and Nevada and finally arrives at San Francisco.

San Francisco is the largest town and seaport on the

Pacific coast of America. It carries on an extensive trade with Europe by sailing vessels round Cape Horn. Lines of steamers run also to Japan, China, and New Zealand, as well as along the Pacific seaboard. It has many Chinese inhabitants.

The distance from New York to San Francisco is 3,300 miles. An express train takes five days and a goods train ten days to do the journey.

What rivers has this railway crossed ? what mountains ? what States ? What river valleys has it ascended or descended ?

Southern Pacific. New Orleans is in Louisiana. At the mouth of what river ? It is the most important town in the southern States. What is its chief export ?

The line runs west, crosses the Rockies, and soon after skirts the boundary of Mexico.

Los Angeles. This is the largest town in the south of California, and has an important fruit market.

The line runs down a river valley and so gets to **San Francisco.**

Name the States, rivers, and mountains crossed by this line.

Trace out the following lines of railway.

I. NEW YORK.

Philadelphia.

Baltimore. On what bay ? In what State ? Baltimore is the only large city in the State, and is a great manufacturing and commercial centre.

Washington, the Federal capital, has neither trade nor manufactures. The city is an exceedingly beautiful one, and contains the Capitol in which the Congress meets, and the "White House," the official residence of the President.

Atlanta is the capital, and one of the chief manufacturing towns of Georgia.

Montgomery is the capital of Alabama.

Jackson is the capital of Mississippi.

New Orleans.

Most of the towns on the Atlantic coast are connected with this line.

II. NEW ORLEANS.

San Antonio (in Texas).

Eagle Pass.

Mexico stands on the interior tableland, at an elevation of over 7,000 feet above sea-level. Mark on your map the railway lines which radiate from this city. Mark also the new and important railway across the isthmus of Tehuantepec.

You have now drawn upon your map a number of main lines crossing the continent from east to west. These lines appear to terminate at Duluth, Chicago, and New Orleans. Examine a political map of the United States, and observe how railways radiate from Chicago, St. Louis and New Orleans. These branches connect the lines that you have already drawn with one another and with the network of lines that covers the eastern States, a network which is too complicated to be marked clearly upon a small map.

There are a number of railways in South America and in various parts of the West Indies, but they are not of the world-wide importance of those whose directions we have just indicated.

Argentina possesses 12,300 miles of railways, connecting the principal cities of the Republic with the capital and chief seaport, Buenos Ayres. There are also some 1,500 miles under construction. One of the most important lines connects Buenos Ayres and Valparaiso, and was opened in 1910.

REVISION EXERCISES.

1. What is meant by latitude and longitude? How does the length of a degree of each vary in different parts of the world? C. J., 1906.
2. Describe the three shortest routes from London to Paris, naming *in order* the chief towns on each. O. J., 1901.
3. Trace carefully by map the courses of the Orinoco and Amazon, showing their tributaries and the chief towns on their banks. C. S., 1888.
4. Write a brief account of the configuration or features of the land, the river systems, climate and productions of Ontario. L. J. S., 1905.
5. Describe the railway route *either* from Paris to Rome *or* from Quebec to Vancouver. What different kinds of country would be passed on the route? Name and state the position of four towns on the route. L. J. S., 1907.

CHAPTER XXII

POLITICAL DIVISIONS

USE a series of maps and mark off in each case the boundary of the province or country mentioned. Note whether these boundaries are natural or artificial. If natural, state how they are formed, e.g. by river, sea, mountains, etc. Insert the capital, the chief river, and the chief mountains. Find the position of the province on the maps, showing isotherms, rainfall, etc., and determine its climate. State what animals, minerals, or vegetables it possesses and what are its chief industries. Mention any large towns and what they are noted for.

Do this carefully for every country and thereby provide yourself with a fairly complete revision of the work of Chapters XI to XXI.

Greenland is a great ice-covered island belonging to Denmark. It is six times as great as the United Kingdom. Godhavn, the capital of the northern division, is well within the Arctic Circle.

Alaska was bought from Russia by the United States in 1867. Its capital is Sitka. When the Russians go to Sitka they travel east and the sun rises earlier for them each day. When the Americans go to Sitka they travel west and the sun rises later for them each day. The Russians keep their Sunday on what the Americans call Saturday. The province is famous for gold and fur-seals.

With the exception of the two countries mentioned above all the rest of North America north of the United States belongs to Great Britain. It is included under the title of **British North America**. This term includes the Dominion of Canada, Newfoundland with Labrador, and the Bermudas.

The separate provinces which form the Dominion of Canada are given below :—

(i) **Nova Scotia and Cape Breton Island** form one province. "Nova Scotia" means "New Scotland." Its harbours are open to ships all the year round. The chief occupations of the Colony are lumbering, mining, and farming.

(ii) **New Brunswick** is joined to Nova Scotia by a narrow isthmus. The country has rich timber supplies and the seas round its shores swarm with fish.

(iii) **Prince Edward Island**, the smallest of all the Canadian provinces, lies in the Gulf of St. Lawrence. Its soil is very fertile.

(iv) **Quebec** is the oldest Canadian colony and was at one time called Lower Canada. It lies on both sides of the St. Lawrence. The majority of the people are French Canadians and their chief occupation is lumbering, the country being largely covered with forests. Wheat, cattle, cheese, and timber are exported.

(v) **Ontario** was formerly called Upper Canada. It is richer and more densely peopled than any of the other provinces. The chief occupations are agriculture and lumbering.

(vi) **Manitoba** is in the middle of the Dominion and was once known as the Red River Settlement. It owes its recent prosperity to the Canadian Pacific Railway, which affords it a means of transport for its excellent supplies of wheat.

(vii) **British Columbia**, which lies between the Rocky Mountains and the Pacific, has a milder climate than the provinces east of the Rockies. It is rich in minerals, and the rivers teem with salmon. Vancouver Island and Queen Charlotte Island form part of the province.

(viii) **Saskatchewan** lies between Manitoba and Alberta, and adjoins the United States on the south. Many towns and villages have sprung up along the line of the Canadian Pacific Railway. The capital of the province is **Regina**. The Northern District has immense resources, and the many fertile tracts will soon be occupied by thousands of industrious and prosperous farmers.

(ix) **Alberta** is bounded by Saskatchewan, the United States, the District of Mackenzie and British Columbia. The prevailing wind is the **Chinook wind** from the Pacific. When this blows the weather becomes mild, and snow rapidly disappears. The province is rich in agricultural resources and has also immense coalfields, and deposits

of iron, gold, silver, galena and copper. The capital is **Edmonton**.

(x) **Northern Canada** is now divided into the districts of Yukon, Mackenzie, Kewatin, and Franklin. The three latter districts were formed out of the "North-West Territories," in January, 1920.

The Governor-General of Canada represents the King, and is appointed by the Crown. Each province has a lieutenant-governor who is appointed by the governor-general, and each has a local parliament to manage its local affairs. There is a Dominion Parliament sitting at Ottawa, which attends to the business of the country as a whole. This Parliament consists of a Senate, whose members are chosen for life, and a House of Commons whose members are elected every five years.

Newfoundland. This colony includes the barren and rocky coast of Labrador from the west end of Belle Isle Strait to Cape Chudleigh on Hudson Strait. The island is larger than Scotland and is subject to fogs as it is near the meeting-place of the Gulf Stream and the cold currents from the shores of Greenland. The chief occupations are seal-fishing, cod-fishing, lumbering, copper mining and paper-making.

The Bermudas are a group of coral islands in the Atlantic, off the east coast of the United States. The porous nature of the ground results in the absorption of all the rain-water, so that there are no wells, and the islands are so small that there are no rivers. Drinking water is obtained by storing rain-water. The situation of the islands gives them all the benefit of the Gulf Stream and they enjoy a wonderful climate. They form a winter health resort for many rich Americans. Their trade is chiefly in vegetables, fruit, and timber, with Canada and the United States. The capital is Hamilton on Maine Island. It is the seat of government, is well fortified, and has an excellent dock-yard.

The United States

These form a Republic. The head of the Republic is the President. He is elected for four years. Each State has its own Government and two Houses of Parliament

to attend to its local affairs. The things that concern the country as a whole are dealt with by Congress, which sits at Washington, and consists of two Houses of Parliament, a Senate, and a House of Representatives.

There is little purpose in learning the names of all these States off by heart, but you should perhaps know the position of the chief States on the Atlantic Plain. The States are sometimes grouped as follows :—

North Atlantic. Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania.

These States are the most densely peopled, and as they have abundant supplies of coal and iron they are remarkable for their manufactures.

South Atlantic. Delaware, Maryland, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, District of Columbia.

These States produce large quantities of cotton and fruit. Agriculture is the chief industry.

North Central. Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas.

These States include the thriving States around the Great Lakes. The large towns are engaged in manufacturing. In the country areas, wheat and maize are grown.

South Central. Kentucky, Tennessee, Alabama, Mississippi, Louisiana, Texas, Oklahoma, Arkansas.

These include the cotton States. What is their chief port ?

Western. These comprise the States not yet mentioned. Name them for yourself.

Mexico is a republic like the United States. Although it is in such a hot region of the globe, the climate on the high plateau is temperate.

Central America contains the following countries :—Guatemala, Honduras, British Honduras, San Salvador, Nicaragua, Costa Rica, and Panama. They are all republics with the exception of British Honduras, which, as its name implies, is a British colony. The whole area is mountainous. The climate on the coast is tropical and unhealthy, but temperate and healthy in the high interior. The chief

productions of the region are coffee, logwood, mahogany and rubber. The country is subject to earthquakes, volcanic eruptions, and sudden thunderstorms. In the republics, political revolutions are as common as earthquakes. **British Honduras** lies along the shores of the Gulf of Honduras in the Caribbean Sea. It is a low swampy plain, covered with large forests of valuable timber. The capital is Belize. The chief exports are mahogany, logwood, sugar, rubber and coffee.

South America contains a number of countries, all of which are republics, with the exception of the Guianas.

Colombia is rich in minerals and exports also coffee and cocoa. The capital, Bogota, stands at an elevation of more than 9,000 feet and has a delightful climate.

Venezuela means "Little Venice." The name was originally given to a village built on piles in a lake. To the discoverers, the water-ways suggested Venice, and the nickname they gave to the village has since been extended to the whole country. The soil is fertile and there are dense forests. Gold, timber, coffee, cocoa, are the chief exports. Caracas is the capital and La Guayra the chief port.

Guiana. Guiana is divided between the Dutch, French, and British. This is the only part of South America held by Europeans. The coasts are unhealthy. The capital of Dutch Guiana is Paramaribo, and of French Guiana Cayenne. The Guianas export sugar, rum, cotton, pepper, timber, and dyewoods. **British Guiana** is fertile and well watered but near the coast is low, swampy, hot and very unhealthy. The chief exports are rum, sugar, cotton, tobacco, timber, and gold. The capital is Georgetown, at the mouth of the river Demerara.

Brazil is the largest country of South America. The chief surface features are the selvas, or forest-covered plains. The country embraces two distinct physical regions—the northern low-lying tropical lands, and the southern and central temperate uplands. Brazil exports coffee, cotton, sugar, tobacco, nuts, rubber, dyewoods and hides. The capital is Rio de Janeiro. Rio de Janeiro, Bahia, Pernambuco, and Para are important ports.

Paraguay lies wholly inland. Its capital is Asuncion.

Uruguay has extensive plains on which horses, sheep and cattle are reared. It exports wool, hides, horns, sheep and cattle, preserved mutton and beef. The capital is Monte Video.

Argentine Republic (Argentina). The country is largely an immense plain, which includes a portion of the Pampas in the south, and in the north the greater portion of an extensive tract called the Gran Chaco, a grassy low-lying area inhabited only by wild beasts and savage Indians. The chief industry is the rearing of cattle, horses and sheep on the wide pastures. The capital and chief seaport is Buenos Ayres.

Ecuador is a mountainous country. The most important vegetable products are cotton and tobacco. The capital, Quito, is at a height of 9,500 feet, and so enjoys a climate of perpetual spring, although it is on the Equator. The chief port is Guayaquil.

Bolivia is an inland republic, and possesses many large silver mines. What lake is in Bolivia? The present capital of the country is La Paz.

Peru is a dry mountainous country. The east is barren owing to deficient rainfall. Only the valleys are cultivated. Peru exports gold, silver, copper, cotton, wool, cinchona, guano, and nitrate of soda. The capital is Lima and the chief port is Callão.

Chile is rich in minerals and has large beds of guano and nitrate of soda. It exports wheat, wool, guano, and nitrates. The capital is Santiago. The chief port is Valparaiso. The port that deals largely with the export of the nitrates is Iquique.

The Falkland Isles form a British colony. They lie 300 miles from the Strait of Magellan. The chief industry is sheep rearing. The islands are a calling place for whalers and trading vessels. The capital is Stanley.

The West Indies

The West Indies stretch in a great curve from South America to Florida. Unlike the greater part of the mainland, they belong or belonged to the various European

Powers. They are divided into a number of groups as follows :—

(i) **The Bahamas**, a British colony. They produce sponges, salt, and turtles. The capital is Nassau on the island of New Providence. In 1492 Columbus landed on the island of San Salvador (now called Watling Island). He was seeking a western route to India, and when he touched land he thought he had arrived in Indian territory. Hence the name “West Indies,” which commemorates both his mistake and his deeds.

(ii) **The Greater Antilles** include Cuba, Haiti, Porto Rico, and Jamaica. Cuba and Porto Rico were taken from Spain, to whom they had belonged for over three centuries, by the United States in 1898. Cuba became a republic, under the protection of the United States, in 1902. The capital is Havana. Haiti or San Domingo is divided between a negro republic and a mulatto republic, and both are peopled by a lazy, degenerate race. **Jamaica** is the largest of the West Indian Islands belonging to Great Britain. It contains large coffee and sugar plantations, grows maize in abundance, and yields almost every kind of tropical fruit. Kingston is the capital and chief seaport.

(iii) **The Lesser Antilles** or Windward Islands. Santa Cruz, St. Thomas, and St. John were purchased in 1916 by the United States from Denmark. Guadeloupe and Martinique belong to France. Many of the other islands are British possessions. They are foolishly divided into “windward” and “leeward” isles. They are all windward isles as they are every one of them in the very teeth of the trade winds. The British “leeward” isles are Antigua, Barbuda, Montserrat, Nevis, St. Christopher, Dominica, and the Virgin Islands. The British “windward” isles include Grenada, St. Lucia, St. Vincent. **Barbados** is a British colony. It exports sugar, molasses and rum and has extensive fisheries. Trinidad produces sugar, timber, and fruit. The capital is Port of Spain.

(iv) **The Leeward Isles**, that is the real leeward isles, are those that run along the shore of Venezuela. The most important is Curaçao. The chief product of the group is salt.

REVISION EXERCISES

1. How do you explain the succession of the seasons and the variations in the length of day and night ? C. J., 1906.
2. Mention and account for the difference in climate between Cornwall and Manitoba in the same latitude. O. S., 1896.
3. On a map mark the boundaries between Canada and the United States ; name the provinces of Manitoba, Ontario, Quebec, New Brunswick and Nova Scotia, without showing their boundaries ; name also Chesapeake Bay and Fundy Bay and the islands of Cuba and Jamaica, the five great lakes, and six rivers ; and mark and name—Chicago, Halifax, Montreal, New Orleans, New York, Pittsburg, Quebec and Winnipeg. C. J., 1903.
4. Write a brief description of the physical features, climate, and natural productions of the Mississippi Basin. L. J. S., 1906.
5. Give some account of the Atlantic coastal plain. How does its breadth vary from north to south ? What forms its western boundary ? Where are the chief towns situated ? O. J., 1907.
6. Describe California, and give an account of its climate and chief agricultural, forest, and mineral products. Name and describe the situation of its chief seaport. C. S., 1903.

CHAPTER XXIII

THE INHABITANTS

THE vast majority of the inhabitants of North America, and about a third of the inhabitants of South America, belong to the white race.

Representatives of most of the European races are to be found living in the United States and in Canada. But by far the majority of the people are of British descent, and the result is that the prevailing language over the greater part of North America is English. In Quebec, however, three-fourths of the people are descendants of the old French settlers, for Quebec was originally colonized by the French. French is spoken, and the Roman Catholic faith is still adhered to. The white people of Mexico, Central America and the greater part of South America are of Spanish origin. Brazil was colonized by the Portuguese, and the white inhabitants at the present day are almost exclusively of Portuguese descent. The Spanish and Portuguese belong to the Roman Catholic Church.

The Red Indians. At the time when America was discovered, the interior was inhabited by the *red* (or copper-coloured) Indians. The Indians have gradually retreated before the white men, and in North America there are only about a quarter of a million of them in the whole of the United States. They are more numerous in Mexico and Central America, but are found in the greatest number in South America, where there are probably 20,000,000.

The various races of mankind are sometimes classed according to their colour, as white, black and yellow. The Red Indians belong to the "yellow" type, and though nothing certain is known as to their origin, it is supposed that they came from Asia across Bering Strait. The name "red" refers to the reddish-brown colour of their complexion, while the name "Indian" is due to the mistake made by Columbus who thought, when he discovered America, that he had reached India. The Red Indians are capable of enduring pain without a murmur, but they are cruel and revengeful. They are clever hunters, and keen observers of nature.

The Negroes were first imported from Africa in the sixteenth century as plantation slaves. In 1863 they were emancipated, and since then they have made considerable advances in civilization and in character. They are found chiefly in the United States, Brazil and the West Indies. They are able to thrive in hot and unhealthy climates, where other races find it difficult to live, and impossible to work. Without the negro, the cultivation of cotton, tobacco, and the sugar-cane could scarcely have been developed.

The Eskimos live in Greenland, and in the Arctic regions of North America. As a rule they live near the sea. They are very conservative in their habits, and have little desire for civilization. The men and women dress alike, in clothes made of sealskin. The chief food is fat and blubber. In summer the Eskimos live in tents, but in the winter they dwell in snow-covered huts. With the arrival of winter they construct beehive-shaped houses of snow, the entrances to which are long narrow tunnels of ice. Inside the huts seal oil is burnt in lamps, and the heat

given off is so great that the occupants can do without clothing. Dogs are used to drag the sledges over the frozen snow. When the sea is open, the men go fishing and hunting, travelling at such times in canoes or *kayaks* made of sealskin.

REVISION EXERCISES

1. What do you understand by (a) the bifurcation of the Orinoco, (b) the selvas of the Amazon, (c) the Pampas, (d) the Cordilleras?

Which South America States produce (e) quinine, (f) cocoa, (g) diamonds, (h) guano, (i) nitrate of soda? C. J., 1893.

2. What part of North America is not drained by rivers running to the sea? State the nature of the climate of the region, and name and describe briefly the chief river of the inland drainage area. L. J. S., 1906.

3. On a map mark the Bay of Fundy, Cape Hatteras, New Brunswick, the States of New Jersey, and South Carolina, the Potomac River; the Adirondack and Appalachian Mountain; the towns Richmond, Wilmington, Portland and Baltimore. Mark the region producing tobacco. O. J., 1907.

4. Describe fully the waterway leading from New York to Lake Superior, and give some account of the trade carried on by means of it. O. S., 1906.

5. What parts of North America suffer from an arid climate? Account for the deficient rainfall in the regions you name. O. S., 1907.

6. Explain why most of the Atlantic region of North America has a considerable rainfall at all seasons of the year. O. J., 1907.

7. On a map—

Mark the Appalachian Mountains and the Sierra Nevada.

Name the Peace River, the Rio Grande del Norte, and the river Hudson.

Show the positions of Lake Winnipeg, State of Connecticut, and the towns of New Orleans, Ottawa, Philadelphia, Detroit, and Denver. O. S., 1907.

CHAPTER XXIV

AFRICA

POSITION AND SIZE

IN studying the geography of Africa, you will usually find that a map showing the whole of Africa will serve your purpose, but owing to the greater amount of detail to be

learned in connexion with South Africa, a map of that region on a large scale will be desirable.

Africa is a vast peninsula. In which direction does it point? Can you think of any other peninsulas that point: (a) in the same direction, (b) in the opposite direction? Give the parallels of latitude marked on your map which lie nearest the most northerly and southerly points. Give the meridians of longitude marked on your map which lie nearest the most easterly and westerly points. Through how many degrees (a) of latitude, (b) of longitude does the continent extend? What parallel of latitude runs through the broadest part of the continent? What is the length in miles of this parallel? (1 degree=68 miles.) What meridian of longitude almost bisects the continent in a northerly and southerly direction? What is its length? (1 degree=70 miles.) Give the breadth of Africa along the Tropic of Cancer, the Equator, and the Tropic of Capricorn. Where does the greater part of Africa lie, north or south of the Equator?

What sea washes the northern shore? What ocean bounds it on the west and south? What sea and what ocean are on the east? From what continent is it separated by (a) the Mediterranean Sea, (b) the Atlantic Ocean? To what continent is it joined at Suez?

See how many circles, each of 1,000 miles radius, you can draw on a map of the continent enclosing land areas. Draw a line inland, parallel to the coast at a distance of 500 miles. Draw another at a distance of 1,000 miles. Is there much land, (a) 500 miles, (b) 1,000 miles from the sea?

In Chapter XI, Revision Exercise 4, the areas of the Continents, etc., are given. The area of Africa is rather more than 11,500,000 square miles. Draw another series of rectangles, similar to those drawn in the above exercise, showing diagrammatically the areas of Africa and of the other places given in that exercise.

Compare the position (writing down the approximate latitude in each case) with regard to the Equator of New Orleans and Cairo, Khartoum and Jamaica, the mouths of the Zambesi and Parana, Panama and Aden, Cape Town and Gibraltar.

REVISION EXERCISES

1. Describe carefully the position of New York, and state as fully as you can the geographical conditions which have made it important.

O. J., 1906.

2. Draw a map of Africa; mark the boundaries of the Transvaal and of the Orange Free State. Indicate the positions of the countries Tunis, Liberia, Abyssinia, and French Equatorial Africa, without drawing their boundaries. Insert five rivers and four lakes and name them. Mark Capes Agulhas, Dolgado; Guardafui; the Gulf of Suez, Delagoa Bay, Walfisch Bay. Mark and name the towns—Algiers, Durban, Fez, Khartoum, Kimberley, Kuanasi, Leopoldville, Port Elizabeth; also Mount Kenia and the Atlas Mountains.

C. J., 1905.

3. By what railway can a traveller go from London to Liverpool? Mention the principal towns he would pass on the way.

O. P., 1903.

4. A trading ship sails from Liverpool to the West Coast of America; what countries between Cape Horn and Vancouver would she coast along? Name in order the chief ports at which she might call. What leading exports might she obtain?

O. S., 1888.

CHAPTER XXV

SURFACE

EXAMINE the map in your atlas, or failing that, a wall map, which is coloured to show the relief of the land. Notice the following points:—

- (i) There is everywhere a narrow strip of plain round the coast.
- (ii) There is a high range in the north-west corner opposite Gibraltar.
- (iii) There is another high plateau in the east at the southern end of the Red Sea.
- (iv) There are ranges of mountains near the east and west coasts.
- (v) There is a broad stretch of country of a lower level than the rest of the continent, running east and west through the northern part of the continent.
- (vi) The narrower southern part of the continent is filled with a plateau of very considerable elevation.

At first sight, the position of the mountain ranges upon the east and west coasts and their absence from the north suggests a resemblance to America, but there is one very

great difference between the surfaces of these two continents. The land between the coast ranges of America forms a series of low plains, whereas that between the coast ranges of Africa is a series of plateaus.

The average elevation of the great inland plateau in the south is about 4,000 feet, whereas in the north it is less than 1,500 feet. The main axis of this enormous plateau extends from the south-west coast to the shores of the Red Sea, and attains its greatest height in the tableland of Abyssinia. The interior plateau is broken here and there by ranges of mountains and by isolated peaks, but there are nowhere extended mountain chains.

(i) **The Coastal Plain** is generally low, hot, damp and unhealthy.

(ii) **The Northern Ranges.** Strictly speaking, we cannot arrange the mountains of Africa in *systems*. They are therefore grouped according to their position on the continent. The northern ranges, which constitute our first group, include the numerous ridges of the **Atlas Mountains**, which extend from Mogador to Cape Bon. The Atlas Mountains consist of a number of more or less parallel ranges, which slope steeply on the seaward side, but have a more gradual descent towards the interior. They are connected by lofty uplands, but here and there deep valleys and precipitous gorges are found. The highest portion of the chain is in Morocco, where there are many peaks, reaching from 11,000 to 12,000 feet, some of which are above the snow line. In Algeria and Tunis the system broadens out and forms a plateau with steep edges. On this plateau there are a number of salt lakes called **Shotts**. They lie in one of the African areas of inland drainage. The fertile and thickly peopled north slope of the mountains which lies in Algeria is known as the **Tell**.

(iii) **The Western Ranges** mark the western edge of the interior plateau and are in several sections. The chief peak is **Kamerun Peak** (13,000 feet); which belongs to a volcanic chain. A part of the chain is under the sea, but the summits of the drowned mountains appear as a number of islands in the Bight of Biafra. Name these islands.

Through the western ranges, the Congo has to break its way in order to reach the sea, and the descent of the river to the coastal plain is marked by rapids and falls, which prevent water-communication between the coast and the Upper Congo.

(iv) **The Eastern Ranges** include the various mountains and ranges on the uplands and along the coast, from the shores of the Red Sea to the river Zambesi.

The Abyssinian mountains form a lofty highland region with an average elevation of about 7,000 feet. They contain deep gorges, with sides rising vertically a mile high, that have been eaten out of the rocks by the action of running water. The highest peaks are from 14,000 to 15,000 feet high and are above the snow line. The plateau shares, with the rest of the eastern tableland, the distinction of being the highest and the oldest part of the continent. It rises, like all the African mountains, in a series of terraces, from the sea.

South of the Abyssinian highlands there is a series of less elevated plateaus, from which large isolated mountain masses and lofty ranges rise. The highest peaks are **Mount Kilimanjaro** (19,680 feet), **Mount Kenia**, and **Margherita Peak**, the highest point in the **Ruwenzori Range**. This last peak was ascended by the Italian explorer, the Duke of the Abruzzi, in 1906. The name "Ruwenzori" means "Rainmaker," and, says the Duke, "a more appropriate one could hardly be found, since, on account of the clouds which continually envelop its flanks, the summits remain invisible for months and months, and even during the brief interval which separates the wet and dry seasons are only seen in the early morning hours. In the dry season they are obscured by haze from the observer on the plains."

The east-central highlands are continued southwards through the Great Lake Region, and on the east of Lake Tanganyika have an average elevation of over 4,000 feet. In the Livingstone Mountains, at the north-east of Lake Nyassa, one peak rises to a height of no less than 11,000 feet.

This eastern group of mountains and tablelands contains the great lake-system of Africa.

(a) **Victoria Nyanza.** This lake was discovered by Speke in 1858 and was then fully explored by Stanley. It is a vast circular basin nearly 4,000 feet above the sea and almost as large as Lake Superior. What parallel of latitude crosses its northern end? What river forms the outlet of this lake?

(b) **Albert Nyanza** is 1,600 feet lower than Victoria Nyanza and is connected with it by the Nile. Its eastern shores rise in precipitous cliffs. This lake was discovered by Sir Samuel Baker in 1864. The country between the Albert and Victoria Nyanzas is called Uganda. What mountains lie between Albert Nyanza and Albert Edward Nyanza?

(c) **Lake Tanganyika.** About how long is it? It is the second longest fresh-water lake in the world and extremely deep, and is surrounded by steep walls. The evaporation is so great that it is generally impossible to see across the lake for mist. For a long time this lake, although its waters are fresh, was supposed to have no outlet. It is now known that when the lake reaches a certain height, its surplus waters are carried away by the Lukuga River, that forms one of the head streams of the Congo.

(d) **Lake Nyasa** is the most southerly of the great equatorial lakes. What is its length? What parallel crosses its upper end? The lake abounds in edible fish. It was first navigated by Livingstone, and is now regularly traversed by steamers belonging to the African Lakes Co.

(e) **Lake Bangweolo** lies west of Lake Nyasa. Livingstone died on its shores in 1873. It, and Lake Mwetu, further north, are drained by the Luapula, a tributary of the Congo.

(v) **The Southern Ranges** include the various ranges between the Zambesi and the south of Cape Colony. The plateau from which they rise comprises the basins of the Zambesi and Orange Rivers, and contains the Great Karroo and the Kalahari Desert.

The eastern and southern buttresses of the plateau are formed by the Drakensberg Mountains and their continuation. The main chain runs parallel to the coast from the Limpopo River to Cape Town. In different parts it has different names, but the longest and highest part is that of

the **Drakensberg Mountains**, rising in its principal sum-
mits to a height of 11,000 feet. Everywhere the moun-
tains rise steeply from the coastal plain and slope gently
inland.

Look at a map of South Africa, on a fairly large scale. You
will see one or two ranges parallel to the coast and very near
it. Between these lies the plateau of the **Little Karroo**.
The next terrace is the **Great Karroo**. Name the parts of
the range that bound it on the north. The next step up
leads to the high veldt, which stretches far and wide
towards the interior and spreads out into the great southern
tableland which contains the **Kalahari Desert**. The
desert is crossed by the Tropic of Capricorn. Here the
belt of calms known as the Calms of Capricorn occurs,
and there is very little rain. The plateau slopes
towards the Equator and contains another of the inland
drainage areas of this continent. On the edge of the desert
is **Lake Ngami**, the centre of the area. The lake varies in
size with the season, and in times of flood has been known
to send an overflow into the Zambesi. The Kalahari
desert is not so barren as the Sahara, for in places there
are wide expanses covered with coarse grass, where men
keep cattle, and where corn can be grown.

(vi) **The Sahara** is a great desert nearly as large as
Europe, extending from the Atlas to the Red Sea and from
the Mediterranean to latitude 25° N. It is a low plateau,
with here and there isolated rocks and plateaus that rise
perpendicularly above its waste of sand. A relief map, or
one coloured to show relative heights will show you a line
of hills running diagonally across the desert from the Atlas
Mountains in the direction of Victoria Nyanza. The Sa-
hara is a desert because it gets no rain. It is for the most
part a sandy, or gravelly, and not a rocky waste, for the
following reason. If a substance be heated it expands; if
it be cooled, it contracts. If a body be repeatedly and
rapidly heated and cooled, that body will often fly to pieces.
In the daytime the rocks of the Sahara get so violently heated
that they will blister the hand that touches them. At night
the land loses its heat rapidly and the temperature has been
known to fall 100°. Frost is quite common towards early

morning. The effect of this alternate expansion and contraction, repeated for centuries, has been that the rocks have split in all directions and extensive tracts of sand have been formed. On the edge of the Sahara is the shallow **Lake Chad**, or **Tsad**, which appears to be gradually drying up. Find from the map whether rivers flow into it or out of it, i.e. whether it belongs to an area of inland drainage or not. Will it be salt or fresh? Why?

REVISION EXERCISES

1. At a certain place on December 25, the sun attained its maximum altitude, which was 14° , at 12.5 p.m., Greenwich mean time. The declination of the sun on the day in question was $23\frac{1}{2}^{\circ}$ S. Find the latitude and the longitude of the place where the observations were made.

C. S., 1906.

2. Give the chief ports on each side of (a) the Irish Sea, (b) the English Channel. Give some account of the reasons for their growth.

C. S., 1904.

3. In a map of Africa mark the meridians (Tunis being 10°) and name the tropics. Indicate the size of a map of Scotland on the same scale. Mark the areas of Abyssinia, Natal, Belgian Congo, Tanganyika. Trace the courses of the Nile and the Zambesi. Insert Cape Town, Suakin, Sierra Leone, St. Helena, Uganda, Tangier.

O. S., 1888.

4. Name the separate parts of the range which forms the main watershed of the promontory of Southern Africa, and describe as regards elevation the country south of this range, and that north of it as far as the tropics. Give the positions of the two highest peaks in Africa.

C. S., 1889.

CHAPTER XXVI

RIVERS AND CANALS

INTO what seas or oceans do those rivers of Africa flow which reach the sea? What lakes receive the waters of those rivers that do not reach the sea at all?

Most of the African rivers are obstructed by falls and rapids. Refer to your physical map and explain this fact. Will these falls and rapids be near the sea in the case of any of the large rivers? How will this affect the utility of the rivers as a means of direct access to the interior?

The hindrances to inland navigation are being gradually

overcome by the building of short railways, and by portages, where the falls occur. In this way the navigable portions of the rivers are being turned to good account. But there can be no real development of the interior of Africa until sufficient railways have been built to afford rapid and regular communication with the coast.

Insert the following rivers on a blank map as you study them, and add the names of all towns, etc., mentioned.

The Congo. Find Lake Bangweolo. A river runs into it on the east. This is the head water of the Congo, but the stream is called the Chambesi. Follow it to Lake Mweru. In what direction does it flow towards the Equator? Find the Arab mart of Nyangwe. Beyond this point the river is called the Congo. It here runs through an enormous plain covered with forests and becomes a mile in width. Near the Equator the Stanley Falls occur. They are named after the explorer who contributed so much to our knowledge of this region. The falls are caused by the river dropping from the plateau to a lower level. In what direction does the river now bend? Note where it again crosses the Equator. This great bend is deep and navigable. It frequently expands into lakes as much as twenty miles broad, which are studded with islands. Follow the course of the river till you reach Stanley Pool. From this point there are 200 miles of river, broken by rapids and cataracts, the first of which is called the Livingstone Falls. At the mouth of the river is Boma.

The basin of the river is as large as Austria, Hungary, Germany, Poland, Czecho-Slovakia, France, Spain and Italy together. The river is 3,000 miles long and the volume of water that it pours into the Atlantic is second only to that of the Amazon. It gets such a large supply of water because it is an area of constant equatorial rainfall. The force of the river is so great that there is no delta and the mud is carried 300 miles out into the Atlantic. Fresh water may be taken up in the sea many miles from the mouth.

After Stanley returned from his explorations on the Congo, a society was formed for the suppression of the slave trade and the opening up of the interior of Africa to civilization. Leopold, King of the Belgians, was at the head

of this society. In 1884 a part of the basin of the Congo was organized as the Congo Free State, under King Leopold, and became a Belgian Colony in 1908. Boma is the administrative capital. The Congo and its tributaries are the main highways for trade to Central Africa. Ocean steamers can reach Matadi. Thence a railway runs to Stanley Pool to avoid the rapids. Thence to the Stanley Falls (1,000 miles) the river is navigable and there are many steamers on the rivers. The steamers use the trees of the forest for fuel. Beyond Stanley Falls there are tributaries and lakes giving about 14,000 miles of navigable waterways, a distance almost equal to the whole coast line of Europe.

The Nile is the longest river in the Old World and there is none other so famous or attractive. If there were no Nile there would be no Egypt. The history of Egypt goes back to the earliest times, and the people ever worshipped the river as a god. They knew not where the river came from, but they knew that once a year it rose with unfailing regularity and flooded their fields with the rich mud that supported their crops and so gave them life.

Find Victoria Nyanza. You will see running into the lake, a river which rises about 3° S. This is the head stream of the Nile. It passes from the northern end of Victoria Nyanza by a series of falls and cataracts. Into what lake does it next flow? These lakes are fed by the equatorial rains, which never completely fail. In what direction does the river run to Khartoum? What is it called? What country does it flow through? This part of the river is navigable for large steamers. At one time it was choked with masses of vegetation, called **sudd**, but this has now been removed. In parts this growth was so thick that an elephant could walk over it! What other branch of the Nile flows in at Khartoum? It is a very turbulent stream and is called the Muddy Nile. From what country does it come? Beyond Khartoum there is only one tributary. Where does it come from? About June, as the sun moves north to the Tropic of Cancer, the rain begins to fall in torrents, and the river rushes down with great fury from the high tableland, causing the Nile floods.

Notice on the map the position of certain cataracts which

are numbered 1st, 2nd, etc. How many are there? At such places the river is narrowed and obstructed by rocks. The path of the Nile through the desert is a cleft in the low northern plateau. Notice the bends of the river between the 1st and the 5th Cataracts. What desert is enclosed in one of the loops? Note the position of Berber. What port on the Red Sea is brought into close connexion with Berber and the Nile by means of one of the loops? What town stands at the 1st Cataract? At this place, a great dam, a mile and a quarter long, has been made to store up water, in times of heavy rainfall, so that Egypt may not suffer for want of water in times of scanty rainfall. At the same place locks have been made to avoid the cataracts, and vessels can pass right from the sea to the Sudan. What town stands in lat. 30° N.? This is the most important city in the country. It commands the whole rail, river, and canal system, and so is the natural site for a political capital. Here the river branches to form a delta. The bulk of the water passes through two streams. What ports stand at the mouths of the two branches?

The Nile is 3,500 miles long. How many degrees of latitude does it pass through? The Lower Nile has 800 miles of unbroken navigation, and leads from the tropics to the Mediterranean and the great markets of the world. It has been explored by Bruce, Speke, Grant, Baker, Stanley, and others.

The Niger. Where do the streams rise that unite to form the Niger? Turn back to the rainfall maps. Is this a dry or a wet area? Will the river be likely to have a large or small volume? In what direction does the river first flow? Note the position of Timbuktu. This is the centre of a great deal of the trade of the Sahara. What meridian of longitude is crossed by the river near its great bend? The bend is caused by the edge of the Sahara plateau. After bending round in what direction does the Niger flow? What important tributary does it receive from the east? Where does the Niger reach the sea? Has it a delta? If a delta exists, does it indicate a slow or a rapid course?

The Niger and its tributaries command the trade of the Sudan both in the west and the centre. They run through

a forest area of untold value, which in time will provide an enormous trade. One of the earliest explorers of the Niger was Mungo Park.

The Zambesi. The chief name associated with the exploration of this river is Livingstone. In some respects the Zambesi resembles the Congo. Both flow right across the plateau, and both are within the tropics. Where do the streams that form the Zambesi rise? In what direction does the main stream flow? In which direction do most of its tributaries flow? What does this indicate as to the slope of the land? What ocean does the Zambesi enter? Name another African river that enters the same ocean. Does the Zambesi form a delta? Is there any important port at the mouth?

The Zambesi is an important river because it gives access to the high plateau of South Africa, a plateau which is inhabitable by Europeans. It flows through a district rich in mineral, animal, and vegetable productions. It contains the finest falls in the world. Above the Victoria Falls, the river is a mile wide. Then it drops 400 feet into a ravine which is only 100 yards wide. What will be the character of the river in this ravine? These falls, though very beautiful, form a great obstacle to the navigation of the river. Find Tete. This is on the edge of the plateau, and here another obstacle to navigation occurs in the form of a series of rapids.

What tributary runs in near the head of the delta? What lake does it connect with the Zambesi? From this lake to Tanganyika there is a rough clearing through the forest, called the "Stevenson Road."

The Senegal is the most important of the second-class African rivers. Near to the source of what important river does it rise? There is railway connexion between these two rivers.

The Gambia rises in the same mountains as the Senegal. The courses of both the Senegal and the Gambia are obstructed by numerous falls, but their lower courses are regularly navigated by French and British trading vessels and gunboats. The volume of both rivers varies considerably according to the season.

The Orange River (1,200 miles). How many large streams unite to form this river? In what mountains do they rise? In what direction does the river flow after the junction? What countries does it pass through? The Orange River has the usual African cataracts, rapids, and lack of tributaries. In the dry season it gets lost in the desert; in the wet season it floods its basin. It has a bar at its mouth over which the surf breaks in fury.

The Limpopo. Where does it rise? Near what bay does it reach the sea? To what countries does it act as a boundary? It has about 60 miles of navigable water useful to commerce.

The most important commercial waterway in Africa is not a river but a canal.

The Suez Canal is cut through the isthmus of Suez. It was constructed by a Frenchman, Ferdinand de Lesseps, and was opened in 1869. It belongs to a Company in which the British Government holds 177,000 shares. In times of war, it is to be open to all ships of war and is not to be blockaded. Egypt is now a British Protectorate; and Britain holding the country guarantees the neutrality of the Canal, and thereby prevents an enemy blocking our Sea-Routes to India and the East.

The canal is entered at Port Said, a very important but most uninteresting place. It consists of warehouses and offices standing on a strip of desert. It is hot and unpleasantly odorous, and the population as a whole is neither pious nor respectable. The canal passes through certain lakes. Name them. Between the lakes the canal is narrow, and steamers have to go slowly to avoid damaging the banks. The journey is hot and wearisome in the extreme. Find Ismailia. From this point there is a railway to Cairo and room has been made for two vessels to pass each other. Arrangements are made whereby vessels can occasionally pass each other in other parts of the canal. The canal is 87 miles long, 28 feet deep, and varies in width from 150 to 300 feet. It took ten years to make and it cost £20,000,000. On an average ten vessels pass through it each day, and seven out of the ten are British.

Before the canal was made, steamers from England to

India, China, and Australia, had to go via the Cape. The canal has shortened these journeys by 3,000 miles.

REVISION EXERCISES

1. Explain fully how the direction of the trade winds is influenced by the earth's rotation. O. S., 1906.
2. Select any railway route from London to Glasgow, and point out how the physical features have controlled its course. Point out the chief industrial districts traversed or touched by the route and the character of the industry. Describe the position of four towns on the route other than London and Glasgow.
Supplementary Clerks Exam., Civil Service, Sept., 1907.
3. Explain by a sketch map the divisions of British South Africa and the courses of the chief rivers. O. S., 1898.
4. Describe the general physical features of the continent of Africa. C. J., 1905.
5. Describe the general course of the Congo and the Zambesi. Where are Albert Nyanza, Khartoum, Kimberley, Massawa, Suakin, and Teneriffe? C. J., 1889.

CHAPTER XXVII

COAST AND ISLANDS

NOTICE the point where Africa comes nearest to Europe. What strait separates it from Europe? At one time the two continents were united. At the present time there is a ridge of submerged land joining the two continents underneath the water. This submarine ridge acts as a barrier, which keeps the cold under-currents of the Atlantic from entering the Mediterranean Sea, so that the temperature of the deep water in the Mediterranean Sea is higher than the temperature of the deep water in the Atlantic, in the same latitude. If we pass from the Strait of Gibraltar and sail in a south-westerly direction, what country is on our left hand? What mountains? Find the positions of the following islands—the Azores Islands, Madeira and the Canary Islands.

(a) The Azores belong to Portugal and are so far from Africa that they ought not to be called African islands at all.

They have a mild climate, a fertile soil, and export pine-apples and oranges. (b) Madeira also belongs to Portugal. It has a dry air, a fertile soil, and grows excellent grapes. The mild climate attracts invalids. The island exports wine, fruit, and cork-dust (used for packing grapes). Steamers call at these islands on their way to South Africa. (c) The Canary Islands belong to Spain. They have a beautiful climate, a fertile soil, and grow grapes, early potatoes and tomatoes for the London market. The capital is Las Palmas, or Grand Canary. The largest island is Teneriffe. Las Palmas is used as a coaling station by steamers. None of these islands stand on the continental shelf, which in most parts of the continent is very narrow. The islands rise up from the depths of the ocean.

Just before arriving in 20° N. what cape do you pass? On the edge of what desert is it? The presence of desert land right up to the edge of the sea is one of the things that has helped to render this part of the coast of Africa an almost valueless one. In longitude $17\frac{1}{2}^{\circ}$ W. what cape is there? It is the most westerly point in Africa. What river runs into the sea just north of it? What islands lie east of it? These islands also belong to Portugal. On one of them (St. Vincent) there is a fine harbour and the place is used as a coaling station. The Cape Verde Islands suffer from drought owing to their nearness to the equator and to the Sahara.

In what direction does the coast turn after leaving Cape Verde? At what point does it turn east along parallel 5° N.? It runs east for 1,200 miles, then turns at right angles and runs south. Just south of the equator, some of the western hills project into the sea at Cape Lopez. From Cape Palmas to Cape Lopez there is a wide gulf. What is its name? It has flat marshy shores, overgrown with the densest tropical vegetation. What large river delta can you find here? What are the "bights" called on either side of the river's mouth? What island is in the more southerly of the two bights? What high peak belongs to the partially submerged chain, of which this island is a part? What other small islands are there, and to whom

do they belong? What river enters the sea in 6° S.? From Cape Verde to this point there is a flat marshy shore, which is a veritable hot-bed of disease.

For 1,000 miles, from the mouth of the Congo, there are scarcely any harbours, and behind the narrow coastal plain rise the mountains that form the western edge of the great interior plateau.

Two distant islands must be noticed, as they are both British possessions.

(a) **Ascension Island.** This island, so called because it was discovered on Ascension Day (1501), is a solitary submarine volcano, rising up from the ridge that runs along the floor of the Atlantic. There is so little rain that the island is practically barren. A large number of turtles are caught during the season, and rabbits abound.

Ascension is under the control of the Admiralty; the governor is a naval officer, in command of a number of seamen and marines with their families. The only settlement is at Georgetown.

(b) **St. Helena** lies about 800 miles south of Ascension, and is another submarine volcano. The valleys in this island are very fertile, and the climate is suited to the growing of vegetables and fruit. The chief interest attaching to St. Helena is derived from the fact that Napoleon was detained here from 1815 to his death in 1821. The island was formerly used as a coaling station for the British fleet, but it has now been practically abandoned by the Admiralty. It has, however, a certain value as a submarine cable station.

What river enters the sea in latitude $28\frac{1}{2}^{\circ}$ S.?

Refer now to a map of the Cape of Good Hope Province, drawn on a sufficiently large scale to show the detail of the coast line. The Cape of Good Hope has about 1,300 miles of coast, but possesses very few good harbours.

Find the Cape of Good Hope. There is a bay on each side of it. That on the north is Table Bay, which is overlooked by the flat-topped Table Mountain. This bay is exposed towards the north-west and is not quite safe when the Anti- Trades are blowing, but a great deal of money has

been spent in building a breakwater, and Capetown is the only place (except Durban) in all British South Africa where the largest ships can lie alongside the wharves.

The most southerly point in the continent lies 35° S., 20° W. What is it? From this point, the next 500 miles of coast face south. The continental shelf in this part of the coast is very broad and forms a big submarine bank, Agulhas Bank.

At Algoa Bay the coast turns north-eastwards. Algoa Bay is one of the best of the South African harbours. It is, however, exposed to the violent south-east winds and cannot take the deepest vessels. Near latitude 30° S. lies Durban or Port Natal, an excellent land-locked harbour, which is being improved so as to accommodate the largest ships. The east coast of South Africa resembles the west, except that the mountains are steeper and come nearer the coast. There is a good natural harbour in latitude 26° S. What is it? What river enters the sea just north of the bay? In what latitude is the mouth of this river? Beyond the mouth of the Zambesi, the Mozambique outcurve swells eastward, ending at 10° S. What cape terminates it? What large island lies to the east? What channel separates it from the mainland? What is the length of the island? What is the breadth of the channel in its narrowest part? Madagascar is the third largest island in the world. In the north and the centre there are mountain masses, which descend to the sea in a series of terraces. The southern end is chiefly desert. The eastern coast of the island is very regular, and is fringed with coral reefs which fill up many of the bays, but the west coast is well indented. Between Cape Delgado and the Equator there is a gentle incurve in which lie the little islands of Zanzibar and Pemba. The two islands, which together form a British Protectorate, stand on the very narrow continental shelf. At what point does the coast turn westwards again? This is the most easterly point of Africa and is the end of the Somali peninsula. What islands lie 150 miles away? They belong to Great Britain and are occupied by tribes of Bedouin Arabs who wander about seeking pasture for their sheep. Find on your map the names of several other island groups.

off this coast between 20° S. and 20° N. Some of these will be mentioned again later on.

After leaving Cape Guardafui, what gulf is entered? What strait connects it with the Red Sea? What country lies on the other side of the strait? Along the African side of the sea there runs a line of cliffs unbroken by any river gaps. This coast ends at the Gulf of Suez. The isthmus of Suez has been pierced by a canal. At the Mediterranean end stands Port Said. What river delta lies west of Port Said? The shore, westwards from the delta, is low and sandy for many miles, but at the east of Tripoli, and in Tunis, rocks project into the sea, forming two gulfs. Name them. The long coast of Tripoli is always beaten by a heavy surf and is of no commercial value. We pass Cape Bon and then Cape Blanco, the most northerly point. From Cape Blanco the coast runs west by south to the Strait of Gibraltar.

The coast of Africa is comparatively useless. It is shorter in proportion to the size than that of any other continent. Africa is three times as large as Europe, but has actually 3,000 miles less coast. This is due to the absence of bays and peninsulas. In some places the desert meets the waves; in others, great cliffs line the shore in a dangerous manner.

REVISION EXERCISES

1. What part of the British Isles has the highest average temperature, and what part has the lowest (a) in January, (b) in July? In each case give a reason. C. S., 1906.

2. Supposing Great Britain were going to be settled afresh by a civilized people, what would be the places best suitable for the capital, for the chief arsenal, for the chief commercial port? Give reasons for your answers. O. S., 1891.

3. Draw a sketch-map of Africa showing the lowlands, the deserts, and four of the chief rivers, with their names. L. J. S., 1907.

4. (a) Where exactly are Ascension Island, the Seychelles and St. Helena? What do you know about them?

(b) Mention the possessions of Great Britain on the West Coast of Africa. O. J., 1895.

(N.B.—The answer to 4b can generally be got quite easily from the map.)

5. Explain the following terms: Tropic of Capricorn, meridian, isthmus, watershed, glacier. O. J., 1892.

CHAPTER XXVIII

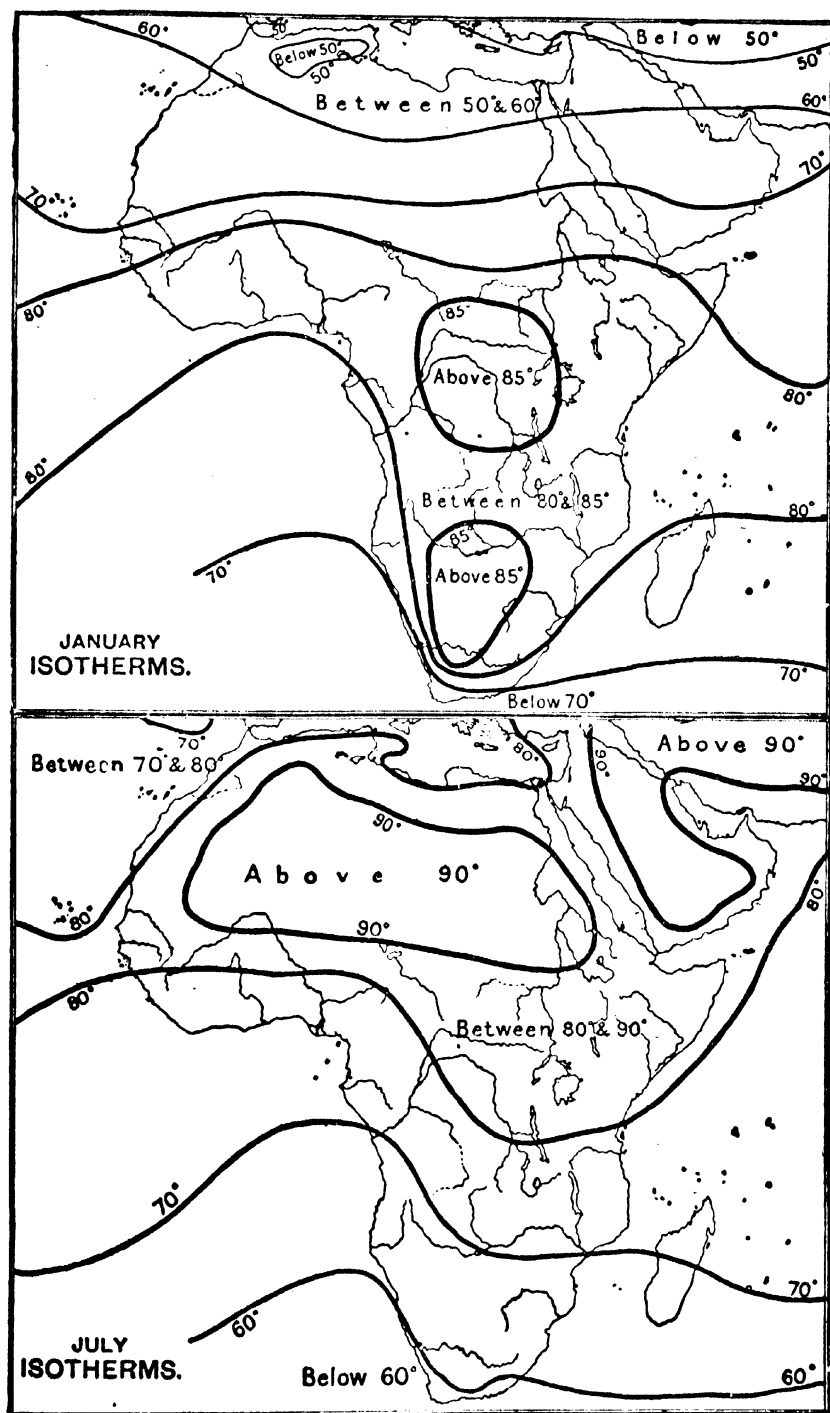
CLIMATE

EXAMINE Fig. 42 showing the isotherms for **January**. They are drawn as if the country were all at the sea level. For every 300 feet we ascend, the temperature falls 1° F. These isotherms, like all those given in the other parts of this book, are drawn to show, not the temperature on the top of a mountain, but what the temperature would be on the ground in the spot where the mountain stands, if you could possibly remove the mountain, i.e. the isotherms "are corrected to sea-level."

Where is the sun in January? What is the average temperature in S. Africa, latitude $23\frac{1}{2}^{\circ}$? What part of Africa in January has a temperature below 50° ? Which part of Africa is farthest from the direct rays of the sun at that time? There is no place in Africa with an average for this month of less than 45° . Which is the hottest month (*a*) in England, (*b*) in Cape Colony? Notice that in the Sahara desert the isotherms are roughly parallel to the lines of latitude at this time. Notice that when the land round the Tropic of Capricorn is having a temperature of 85° F., there are places in the same latitude with a temperature between 65° and 70° . These are near the coast where the effect of the sea is felt. In the waters south-west of the continent, a cold current from the Antarctic keeps the waters in this part of the world cooler than they otherwise would be and produces a corresponding effect on the climate of the coast. What are the temperatures of different parts of Africa along the Equator?

Examine Fig. 43 showing the isotherms for July. Where is the sun at this time of the year? Where is the hottest region? Why should it be so hot? What is the average range of temperature at the mouth of the Nile, Gibraltar, the mouth of the Congo, Cape of Good Hope, Madagascar? Why do you think the east coast is generally warmer than the west, even in the same latitudes? If you travelled

AFRICA—CLIMATE



FIGS. 42, 43.—AFRICA: JANUARY AND JULY ISOTHERMS.

from Suez to Cape Town what isotherms would you cross (a) in January, (b) in July ?

Examine Fig. 44 which shows the isobars for January. The isobars are also "corrected for sea-level," because as we ascend, the pressure of the atmosphere decreases at the rate of 1 inch for 1,000 feet. Where is the region of low pressure ? Where is the sun at this time ? Why should the two be related in the way they are ? Where is the coldest area ? The greatest pressure ?

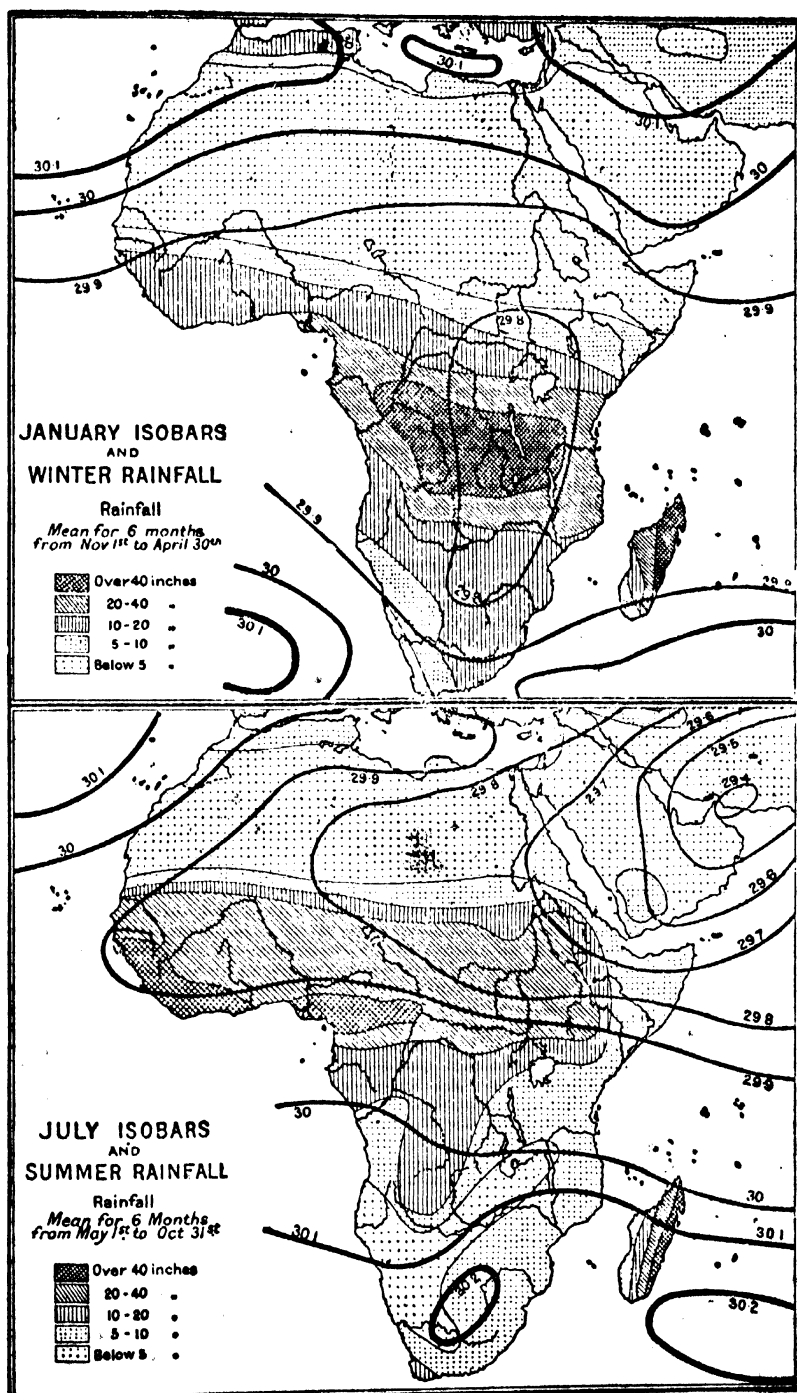
Examine Fig. 45 which shows the isobars for July. Where is the region of (a) highest, (b) lowest pressure ? Compare these with the positions of highest and lowest temperature. What winds blow over Africa (a) outside the Tropic of Cancer, (b) between the Tropic of Cancer and the Equator, (c) between the Equator and the Tropic of Capricorn, (d) south of the Tropic of Capricorn ?

Why do you suppose the isobars are so regular in the south, and so irregular in the north during July ?

There is nearly always rain on the Equator. Therefore there must always be a fair amount of moisture in the air, and this screen of moisture tends to keep the sun from having its full heating effect upon the earth. It also tends to prevent the earth losing its heat by radiation. This wet blanket thus has the effect of tending to preserve an equable temperature along the Equator. But north and south of this belt there is very little rain, and therefore no blanket to screen the earth from the fierce rays of the sun ; and the absence of such a screen tends to make the climates of places outside the wet area more variable than they would otherwise be.

When the sun is in the south, the southern part of the land gets heated ; the hot air rises ; and cold air flows in from the sea. This cold air, laden with moisture, ascends into the upper and cooler parts of the atmosphere. The air is chilled, the moisture is condensed, and rain falls. As the sun moves north the same thing happens in different places and the wet belt follows the sun. As the sun comes back again, the rainy belt moves with it, so that places within the tropics get two rainy seasons each year.

Notice that the Sahara is dry even when the sun is



FIGS. 44, 45.—AFRICA: JANUARY AND JULY ISOBARs AND WINTER AND SUMMER RAINFALL.

north of the Equator, and that the Mediterranean gets its heaviest rains in January. Will the lakes and rivers which feed the Nile receive much water (a) in January, (b) in July? When does the Congo get its greatest supply?

The examination of the above maps should enable you to understand the following short summary of the conditions affecting the climate of this great continent, and their results. But before reading this section of this chapter, turn back and revise the subject of Trade Winds (Chapter IX).

Africa extends through 70° of latitude and so has many varieties of climate, but as the greater part of the continent lies between the tropics, it is hot almost everywhere. The north is hotter and drier than the south, partly because there is more land within the tropics in this part of the continent, and partly because of the presence of Europe and Asia on its northern coasts. What variations of climate are to be found are chiefly due to variations in height and moisture. In Abyssinia all the peaks above 13,000 feet are covered with perpetual snow, and on the high plateau that fills so large a part of the continent it is cooler than in the same latitudes on the low coast. This is not shown by the isothermal lines given in Figs. 42 and 43 because, as previously explained, these have been corrected for sea-level.

The greater part of Africa lies within the tropics, so that its chief winds are the north-east and south-east Trade Winds. These winds blow towards the east coast, and cause a heavy annual rainfall on the east coast; they then pass across Africa, getting dryer and dryer, and so deposit but little rain on the west coast.

The Anti-Trades blow only to the west coast and outside the tropics. They therefore reach only the north-west and south-west corners. These winds bring moisture, but the Atlas Mountains in the north-west, and Table Mountain in the south-west, deprive them of this before they get far inland. Every place within the tropics has two rainy seasons, and at each tropic there is a belt of calms for half the year, during which time much of the interior gets very little moisture, and therefore there is a desert along each tropic.

In considering a small country like England, or a small continent like Europe, it is fairly easy to describe the climate of the country or the continent in a few general phrases. That this is not the case in a continent of the size of Africa is at once apparent from an examination of the maps. In describing the climate of any particular region many local or semi-local circumstances have to be taken into account. Consider one or two examples of this.

(i) The Canary Islands are in the same latitude as parts of the Sahara. They have a mild climate without extremes of temperature, whereas in the Sahara you can be both roasted and frozen within 24 hours. The Canary Islands owe their mild and equable climate to the fact that they are surrounded by sea.

(ii) The hottest part of Africa is not on the equator, for the land there is chiefly highland, and the effect of altitude is to diminish the temperature. The hottest part lies between 10° N. and 20° N. where the mass of land is greater and its average elevation lower.

(iii) The Mediterranean coast. In the east it is low but in the west it is high. It lies outside the tropics, and therefore the prevailing winds will be chiefly south-west winds. During the winter months they come from warmer water to cooler land. The Atlas Mountains intercept these winds, condense their moisture and produce a copious winter rainfall. So great is the rainfall that when the winds pass inland they are dried, and have no moisture left for the lands beyond. The climate of this coast is that of the Mediterranean in general. (See Part I, Chaps. 3-5, 7, 9.)

(iv) The Sahara is crossed by the Tropic of Cancer. It lies in a belt of calms and for months gets no rain. Winds reach it from the sea, but they bring no rain. The intense heat draws air in from the west, but evaporates any moisture such air may contain. Moist winds come from the east, but on that side there are no mountains to condense the moisture and the air over the desert itself is very hot. Moist winds come from the north-west, but there the Atlas range is so high and so broad that all the moisture is removed before the wind reaches the interior.

(v) The Cape of Good Hope climate varies according to

elevation and nearness to the sea. Speaking generally, the climate is hot and dry. The rain falls in the east in summer and in the west in winter. The chief winds are the south-east Trades, but they lose their moisture on the slopes of the eastern hills. Hence Grahamstown has an annual rainfall of 40 inches, while in the Great Karroo the annual rainfall is only 5 inches. The atmosphere of the Karroo is so dry and clear that the climate affords relief, and in many cases a permanent cure, to people suffering from lung troubles. The rain-bearing wind for Cape Town is the north-west one. Owing to Table Mountain acting as a condensing medium, Cape Town has a rainfall of 30 inches. As you ascend the mountains the climate approaches that of Europe. In winter there are sunny days and frosty nights, and snow frequently covers the summits of the highest mountains.

REVISION EXERCISES

1. The members of a certain life insurance society are permitted, on payment of the ordinary English premium, to reside in America, north of 33° , and in Africa south of 25° . Explain clearly (a) the meaning of the symbols 33° and 25° . Decide, with geographical reasons, whether (b) the permission refers to North or South Africa or America, (c) why the permission does not read "south of 33° and north of 25° " nor (d) "in Africa, north of 33° and in America south of 25° ." O. S. 1899.

2. In what parts of North America are the following chiefly found :— Coal, copper, petroleum, timber, cattle, sheep? What are the chief manufactures of Canada, and where are they carried on?

Give the position of the main wheat-growing area in North America, and explain the importance of the maize crop in the United States.

C. S., 1903.

3. Draw a sketch map of Africa south of the Zambesi, marking and naming the rivers, and inserting the boundaries of various states and colonies. Insert in the map Bloemfontein, Bulawayo, Delagoa Bay, Durban, Kimberley, Port Elizabeth, Pretoria and Salisbury. C. S. 1897.

4. Explain the statement that within the tropics the rain follows the sun. Give illustrations of this rule from the times of the rising of the Nile and Zambesi. C. S., 1889.

5. Compare and contrast the leading mountain ranges in Africa and South America with respect to (1) position, (2) direction, (3) influence on climate. O. S., 1888.

CHAPTER XXIX

VEGETATION

EXAMINE Fig. 46 which shows the distribution of certain areas of vegetation. The distribution is fairly simple. Where there is an abundance of rain, forests exist. By comparing this figure with a political map, say which countries possess forest areas. Where there is no rain, or very little rain, there is desert. Name the countries which have desert areas. Where the rainfall is moderate, there are lands partly cultivable, on which grass grows naturally, and on which other plants can be grown. Observe that the equator runs through the midst of the forest area. The forests are in the centre of the country. Then north and south of this area there are grass lands, which also extend southwards along the east coast behind the narrow coastal forest belt. Along either tropic there lies a belt of desert, and outside each desert area, and bordering the ocean, there is an area where plants belonging to temperate regions can be grown.

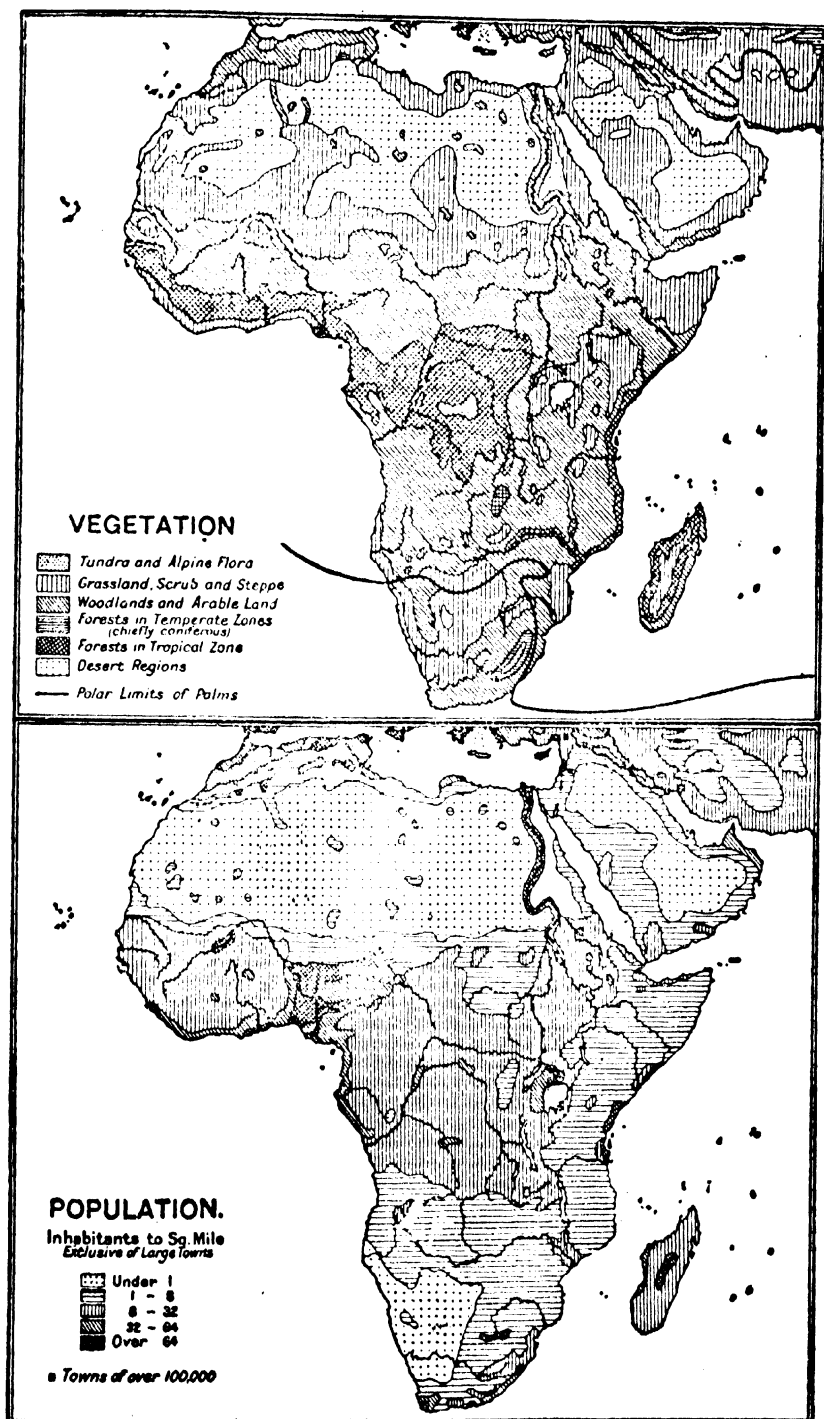
(i) **The Forest Areas.** Neglecting for the present the narrow forest belt along the wet part of the east coast, let us consider the equatorial forest. It is the most unhealthy as well as the most fertile part of the country. It is hot, being on the Equator; it is damp, being in the region of heaviest rainfall. What great rivers run through this forest? The forest is 1,200 miles broad and is the largest forest in the world after the Selvas of the Amazon. In that part of it which lies in the Congo basin, the forest is the densest and most tangled in the world. It is so dense that it is impenetrable, and except along the banks of the rivers, is practically unexplored. In places the thick growth will not allow the light to penetrate, and darkness reigns. The African forests contain many plants useful to man, of which the chief are the banana, ebony, teak, mahogany, coffee, rubber, and the oil palm. The oil palm is especially abundant in that part of the forest bordering the Gulf of Guinea and lying in the basin of the Niger. The pulp of the fruit of the oil palm is boiled in water,

and the oil which rises to the top is skimmed off. This oil is a valuable African export and is used in making soap and railway grease.

Such plants as maize, millet, tobacco, hemp, and sugar, flourish wherever they can be planted. In all the muddy estuaries in the tropics the mangrove grows. This tree sends down roots from its branches which bury themselves in the ground. Its fruit is sweet and pleasant.

(ii) **The Savannahs or Grass-lands.** As a rule, when we pass from the tropical forests where trees grow in abundance and there is little or no grass, we get to a region of park-like lands called savannahs where both trees and grass grow. Beyond the savannahs are the steppe lands where there is grass and no trees, and beyond the steppes are the deserts where there are neither trees nor grass. In Africa the savannah and desert areas are large, and the purely steppe districts comparatively small. Like the steppe regions, savannahs have a long season of drought and death and a short season of rain and life, and it is during the short wet period that plants like grass flourish. In Africa the savannahs lie outside the tropical forests and also extend down the eastern coast as far as the Zambesi. They resemble the llanos of Venezuela, the campos of Brazil and the park-lands of England, where clumps of trees are scattered amidst grassy fields and glades. Several native tribes live a nomadic life on the savannahs, following their herds and flocks from place to place. In other parts, a certain amount of agricultural work is done by the natives, and millet and other food plants are grown. In South Africa, the grass-lands are largely occupied by the pastoral Boers of Dutch descent. The baobab or "monkey bread" tree is found on the savannahs and in the forests, and its trunk sometimes measures as much as 100 feet in circumference. Its bark is of great value in the treatment of fevers, and therefore the tree is particularly valuable in a country where fever-stricken areas are only too common. The bark can also be used for making ropes and clothes. The fruit of the tree is about as big as a lemon. Its acid pulp is eaten by the natives as a food.

(iii) **The Deserts.** No plant can live in a sandy desert



FIGS. 46, 47.—AFRICA: VEGETATION AND DENSITY OF POPULATION.

like the Sahara which cannot protect itself against drought. Certain plants, such as prickly acacias, thorny plants, and coarse grasses that can withstand loss of water by reason of their thick coats, and others that can store up water in bulbous roots may be seen growing in scattered tufts with broad barren spaces between. But the Sahara is a desert merely for want of water, and not because it is naturally unfertile like a granite plateau. On the contrary, wherever water is found, various kinds of plants grow in profusion. Such fertile spots in a desert are called oases. Far below the surface of the sand there are frequently supplies of water, and in many parts of the French Sahara engineers have bored artesian wells, and have turned acres of arid desert into fertile gardens. The chief grains grown in such places are rice and millet. But the chief product is the invaluable date-palm. A date-palm will produce from 300 to 600 lb. of dates per tree. In parts of Arabia and Northern Africa, dates, which are very nourishing, form the principal food of the people. The date-palm provides the traveller through the desert with food, timber, and shade. It blesses and beautifies every oasis.

The Kalahari Desert is a series of barren steppes swept by scorching winds. It is largely covered with a lifeless scrub, but wherever there is water, the tall grey-green acacia grows. After heavy showers, the desert is gay for a few weeks with many varieties of beautiful flowers.

(iv) **The Northern Temperate Region.** This lies along the north coast of Africa, chiefly between the mountains and the sea. Morocco, and the other states near it, can grow almost anything. They raise crops of wheat and barley, and in the Tell they grow olives, grapes, oranges and lemons. There are forests of oak, groves of figs and olives, vineyards, and wheat-fields. On the plateau of the Shotts, esparto grass is grown. This is pulled up, packed in bales, and exported for paper making.

(v) **The Southern Temperate Region.** This includes the Cape of Good Hope and the regions, say, south of $23\frac{1}{2}^{\circ}$ S. Nearly two-thirds of the Cape of Good Hope consists of vast dry plains covered with heaths, which vary in

size, according to the amount of rain available, from 15 feet to a few inches. After rain the "change is simply magical; the blackened bushes and shrubs put forth leaves, and the ground is carpeted with a profusion of flowers of the brightest and most varied colours and with rich grass." In the forests of the east and south many kinds of valuable timber are found. The chief grasses grown are wheat, oats, maize, and millet. The grain districts are in the west, for a dry climate is more suitable to wheat, etc., than a wet one. All kinds of European fruits and vegetables can be grown. Tobacco and the vine are both cultivated, but neither the tobacco nor the wine have, as yet, taken a firm hold of the European market.

(vi) **The Nile Valley** forms a special district of its own. It depends for its water supply on the overflowing of the Nile. Egypt is "the gift of the Nile." Every year the river overflows, and when the waters subside, a layer of rich fertile mud is left behind. If the water rises less than 22 feet, famine occurs; if it rises more than 26 feet, destructive floods occur. The water is carried in many directions by canals to irrigate the fields. Quite recently English engineers have completed a series of great storage works to prevent the flood water from being wasted. In this way much water is saved, and the country can be artificially irrigated during the summer, when the Nile floods have disappeared. The mud left by the river is so fertile that practically anything will grow in it. Grains sown in November can be harvested in May. Cotton, sugar, and rice sown in March can be gathered in October. Rice and vegetables sown in July can be gathered in September. Cotton is indigenous to Africa and forms one of the chief Egyptian exports.

Below is given a list of the various countries of Africa with their principal vegetable productions. Take a blank map of Africa with the country boundaries marked, and write in each country the names of the things grown there. In each case, notice how the rainfall, the temperature, etc., are responsible for the distribution of the different plants. If you can, get pictures of the various kinds of trees, etc., whose general appearance is unknown to you.

Morocco. Wheat, barley, oranges, maize, apricots, grapes.

Algeria. Wheat, barley, grapes, esparto grass, olives, cotton, rice.

Tunis. (As for Algeria.)

Tripoli. Dates, grains, grapes, cotton.

Egypt. Wheat, maize, rice, clover, cotton, sugar, beans, flax, hemp, dates.

Cape of Good Hope. Wheat, oats, maize, millet, European fruit, grapes, tobacco.

Natal. Tea, coffee, sugar, arrowroot, maize, millet, European fruits and grains and tobacco.

The Transvaal. Coffee, rice, maize.

The Orange Free State. Maize, wheat.

The Sahara. Dates.

Mauritius. Sugar.

Zanzibar. Cloves.

Madagascar. Teak, ebony, rosewood, and cotton on the damp, deadly east coast.

Western Africa (name the several states). Palm-oil, gums, india-rubber, ebony, coffee, ground nuts.

Eastern Africa (name the several states). Oil nuts, rubber, gums, coffee; and on the uplands, oats and barley.

REVISION EXERCISES

1. When it is noon in London, what is the time at (a) Vancouver, (b) Cape Breton? C. J., 1900.

2. Describe the position of the South Wales coalfield. Explain why large quantities of Welsh coal are exported to foreign countries and name the seaports from which most of it is shipped. O. P., 1906.

3. In what parts of Africa are there (1) deserts, (2) grass-lands, (3) forests? Illustrate your answer, if you can, by a sketch map of the continent. What connexion is there between rainfall and the places where forests are found? L. J. S., 1905.

4. Explain why the Trade Winds blow the way they do. Account for the difference of rainfall on the west and east sides of the continent of North America. What is meant by North Pole, midnight sun? C. S., 1892.

5. Which are the chief arid regions of the globe and why are they so? Are such regions necessarily unfertile? C. S., 1892.

(N.B.—Illustrate your answer by reference to Europe, North and South America and Africa. For the present neglect Asia and Australia.)

CHAPTER XXX

ANIMALS

ALL the native animals north of the Sahara belong to what is known as the Old Northern Realm. This extends over Europe, Asia north of the Himalayas, and Africa north of the Sahara. The typical animals of the grass-lands of the Old Northern Realm are sheep, cattle, and goats. The typical animals of the forests are wolves, foxes, and bears.

The native animals of Africa belong chiefly to what is called the Ethiopian Realm, which includes Africa, south of the Sahara and the southern extremity of Arabia. "Here the lion, long claimed as the 'king of beasts,' the spotted leopard, the gorilla (an ape as tall as a man and far stronger), many other tribes of narrow-nosed, tailless apes, the two-horned rhinoceros, the tall giraffe, the clumsy but sagacious elephant, and the ostrich, whose long legs more than make up for its powerless wings, wander through the woods, or race like the graceful antelopes and striped zebras across the plains. The unwieldy hippopotamus and armour-clad crocodile splash in the muddy rivers, while the flesh-eating vulture, with its long, bare neck, sails through the air, watching for its prey." (Mill.)

But these animals are not distributed uniformly over the continent. Each special zone of vegetation has its own particular fauna or collection of animals.

(i) **The West Equatorial Forest** is too dense for animal life to be very abundant.

The Gorilla is the largest ape known and a native of Western Africa. **The Chimpanzee** is another ape, also a native of Western Africa and very common near the Gabun. Specimens have been brought to England from time to time, but they never live long..

The Hippopotamus, or "river-horse" of Africa is an enormous unwieldy animal with massive feet and a thick skin. Between the skin and the flesh there is a layer of

fat, which is salted and eaten in different parts of South Africa. The hippopotamus feeds entirely on grasses, shrubs or other vegetable substances. Fossil remains of this animal have been found in Britain. What does this prove?

The Elephant is hunted chiefly for its ivory, and the hunting has been so fierce and reckless that there is a danger of the animal becoming extinct, when the world will lose its chief supply of ivory. The tusks of an African elephant often measure 6 feet in length, and a pair of them will weigh from 80 to 120 lb. Ivory is sometimes worth £90 a hundredweight.

(ii) **The Great Eastern Plateau.** This abounds in "big game."

The Lion once roamed all Africa from the Atlas Mountains to Table Bay, but to-day it is only to be found north of the Orange River. The lion is a member of the cat family. As it feeds on animal food it can only live where other animals can be found. It possesses great courage, swiftness and strength, and can fell an ox with one blow of its paw. It is solitary in its habits, and usually hunts alone. It moves from place to place as game becomes scarce.

The Giraffe is the tallest animal known, its height varying from 15 to 20 feet. The greater part of this height is due to the enormous length of the neck. The giraffe has an unusually long cylindrical tongue, which is prehensile, and is used for stripping the leaves off the trees on which it feeds.

The Zebra belongs to the horse family. It is peculiar to the high parts of South Africa, and has been domesticated, though with very considerable difficulty.

The Crocodile is a reptile, closely related to the lizards, but its back is covered with bony plates overlying a covering of scales. Crocodiles abound in the fresh waters of hot countries and are particularly numerous in the Nile. They lay their eggs in the sand and allow the heat of the sun to hatch them. The young are not more than 6 inches long, but the full-grown animal often measures 20 feet.

The Rhinoceros has an unwieldy body and thick short

legs. Its hide is very thick and almost bullet proof. The rhinoceros leads a quiet lazy life in the mud, on the edges of lakes and rivers. It has wonderfully keen scent and hearing, and is not easily attacked. When brought to bay it charges with great speed and fury.

The Tsetse Fly is one of the most deadly of insect pests, though in size it is but little larger than a house-fly. Its bite causes the death of domestic cattle, but does not affect man or wild animals. It abounds in South Africa.

(iii) **The Animals of the Desert.** The Camel is the "ship of the desert" and was introduced into Africa from Arabia. It can travel 30 miles a day, carrying a load of 400 lbs. Its broad flat feet prevent it sinking in the sands of the desert. It has long eyelashes and can close its nostrils, so that it can protect both its eyes and nose during the sandstorms. The camel eats almost any kind of shrub, and has water-pouches in its stomach, so that it can store up water for its needs. Strings of these animals, forming caravans, traverse the desert in many directions, bearing the products of the hot lands, ostrich-feathers, ivory, skins, gold-dust, and dates.

The Ostrich is valued for its feathers, to obtain which, it was formerly killed. Now it is kept in enclosures and its eggs are hatched in incubators. With a blow of its foot an ostrich can fell the strongest man. When the feathers have to be plucked, mounted men drive the birds with a thorn bush into a small enclosure where there is no room to kick. The feathers are black, drab, or white, and constitute a most valuable export.

The Nile Valley has many varieties of aquatic birds such as the stork, pelican, and flamingo.

Madagascar has plants and animals which are not like those of Africa but rather like those of Eastern Asia, and it is supposed that at one time this island was united to India. Legend states that Madagascar is the native home of the Roc, the mighty bird that carried Sinbad the Sailor from the Diamond Valley. As fossil bones have been found of a bird that stood 10 feet high and laid an egg a foot long, perhaps there may be some truth after all in the Arabian fable.

One of the curious existing animals is the **lemur**, which is found in large numbers in this island and in but few other places. The word "lemur" means "ghost." These animals move about only in the night time. The most remarkable of all the lemurs is the **aye-aye**, which is about as big as a cat and is covered with thick dark hair. It has the teeth of a rat and a long skeleton hand. It feeds on fruits, bamboo-pith, and the juice of the sugar cane.

The Mediterranean Region is the northern temperate region. The chief animals are sheep and goats. They are fed on the alfa (esparto) grass, and on the sweet herbs that are found on the sides and on the plateaus of the Great Atlas Mountains. These animals provide the wool and skins which support the carpet and leather industries for which Morocco is so famous.

South Africa is the southern temperate region. The Cape possesses millions of cattle, sheep, goats, and horses, and exports almost as much wool as Queensland. Most of the sheep belong to the merino breed. As the grass is very thin, the farms are very large, ranging from 3,000 to 13,000 acres. Goats can live where sheep cannot, as they do not confine themselves merely to grass, but will eat bushes, etc. There are so many goats in some parts of South Africa that their flesh forms the chief meat supply. The best breed is that of the Angora goat which was brought from Persia and Kashmir. Its beautiful long silky hair is the *mohair* of commerce, and the Angora goat is reared in such numbers in South Africa that this part of the world now produces the largest supply of mohair. Dairy farming is becoming an important industry, but less butter is made than is needed, and in winter butter is sometimes sold for 6s. a pound.

The Orange Free State is almost entirely a pastoral country, and has extensive grazing grounds for sheep and cattle. Sheep-farming is the most important occupation of the people. The same is true of the Transvaal. The Boers drive their sheep, in the winter, to the northern marshy veld, or bush veld as it is called. In the summer, when the rains have produced a new supply of grass, they bring the sheep back again to the high veld.

REVISION EXERCISES

1. Explain the formation of fog and mist. Why is fog or mist specially common (a) on mountain tops, (b) in marshy lands, (c) in London ?
C. S., 1906.
2. Name the chief ports on the east side of Scotland, describing briefly the position and the trade of each.
C. J., 1899.
3. On a map of Africa mark Algeria, Abyssinia, the Atlas Mountains, the rivers Congo, Nile and Zambesi, Cape Verde, Alexandria, Zanzibar, Tangier, Port Said.
O. J., 1893.
4. From which of our African colonies or protectorates is each of the following products obtained : cloves, coffee, india-rubber, palm-oil, sugar, wool ?
C. J., 1897.
5. Contrast the vegetation of Belgian Congo with that of North Africa. How do you account for the difference ?
O. J., 1896.

CHAPTER XXXI

MINERALS

TAKE a blank map of Africa, having the boundaries of the countries marked. Write in each country the names of the minerals found and insert the names of all towns given.

Coal is found in the basin of the Zambesi. It is worked chiefly in Natal, the Cape of Good Hope and the Transvaal. The Cape coal, which is quarried out of the hill-side, is poor in quality but is used by the South African railways and also by some of the railways in the East. Natal has an abundance of good coal. There is probably more coal in Natal than there was in England before the first mine was worked. The chief mines are at Dundee and could produce 1,000 tons a day.

Iron. It is known that there are large quantities of iron in Tropical Africa. There are valuable deposits in the Atlas Mountains, and these are chiefly worked in Algeria. Natal also has iron mines.

Gold is found in the south and south-east of Africa and on the Gold Coast. This coast, being known as the Guinea Coast, gave us our word **guinea**. Long before people had found gold in California and Australia it was exported in large quantities from the Gold Coast. When the slave trade was abolished, labour became dearer, and the industry lan-

guished. Gold is still exported, but the most valuable products at the present time are rubber, ebony, and palm-oil. The Gold Coast is a British possession. It extends back into Ashanti, which was conquered and added to the Empire in 1896. The capital of the Gold Coast is Accra. Cape Coast Castle is an important trading town.

Southern Rhodesia has two main sources of wealth, grain and gold. The watershed in this region is chiefly of granite, but it is intersected by areas of gold-bearing quartz. There is an abundance of water and timber, both of which are necessary to successful mining. The chief town is Bulawayo.

The Transvaal has very rich gold mines. Mark on your map the hills that divide the basins of the Orange and the Limpopo. Along the northern rim of this ridge is the Witwatersrand (or simply the Rand) goldfields. They were discovered in 1885. The ridge consists of quartz with pieces of sandstone embedded in it. In the sandstone gold is found. A lump of this rock looks like almond-toffee. The reefs containing the rock run under the ground and the quartz has to be extracted by mining. When the quartz comes to the surface it is broken into pieces and crushed to powder. The powdered ore is treated with mercury which unites with the gold. The amalgam of the two metals is boiled and the gold is left behind. Over 200,000 ounces of crushed pure gold have been got out of these mines in a month, and that means the crushing of enormous quantities of rock. If a ton of quartz contains half an ounce of gold it pays to work it. The largest gold-mining town is Johannesburg, which has grown from a number of rough shanties in 1885 to a large city of over 150,000 inhabitants.

Copper is worked in the Cape of Good Hope and the Atlas region and to a small extent in the basin of the Congo. The most valuable deposits are found in the old rocks of Namaqualand. It is shipped from Port Nolloth.

Salt. In most parts of the Sahara, the porous sand lets all the water that falls upon it filter away at once. But on the northern edge of the Sahara, and amongst the high parts of the Atlas Mountains, the ground is so hard that the water cannot run through. It evaporates and leaves salt

behind. In this way parts of Western Sahara are covered with salt, which forms one of the chief commodities of the desert trade. It is mostly sent south through Timbuktu. The inland drainage area round Lake Ngami also produces salt.

Diamonds are confined to Griqualand West, the Orange Free State and British South-West Africa. The centre of the industry is Kimberley, which has been described as a "shabby, sun-burnt, tin-built town." In summer the heat is tremendous and the dust lies two feet deep in the streets. The diamond mines are now mostly in the hands of the De Beers Consolidated Mines Co. The diamonds are found in mines, in the "blue-clay." This is quarried out and then exposed to the weather. After about nine months' exposure the clay falls to powder. It is then washed, and the dirt being washed away, the stones are left behind. Since 1867, over £100,000,000 of diamonds have been exported.

The work of mining is chiefly done by the Kafirs. As they are expert thieves, they have to be very carefully watched. They engage to work for so many months at a time and during that time they are shut up in "compounds." When they leave they are carefully searched, but though every precaution is taken they occasionally manage to steal some of the stones.

REVISION EXERCISES

1. Give a short account of the action of rain as an agent of denudation.
C. S., 1906.
2. Draw a sketch map of the east coast of Ireland from Fair Head to Wicklow Head. Name the counties and mark the divisions between them; also name the river mouths, inlets, and towns between the two limits named. Give the latitudes of these limits.
C. J., 1906.
3. On a map of South Africa insert: Cape Town, Port Elizabeth, Kimberley, Durban, Pretoria, Johannesburg, Lorenzo Marques, the Drakenberg Mountains, three rivers and two lakes, the Cape of Good Hope, Cape Agulhas, Delagoa Bay, Walfisch Bay, and the island of Zanzibar.
C. J., 1895.
4. Give a brief account of the climate, healthiness, and fertility, of Egypt and Sierra Leone. What are the staple articles of food produced in the Sudan and Zululand respectively? What parts of Africa are best adapted for sheep farming and in what parts is gold found?
5. (a) What are the chief natural products of the Cape and Natal?
(b) Describe the position of Cape Coast Castle, Zanzibar, Sierra Leone, Durban, Socotra.
O. J., 1892.

CHAPTER XXXII

OCCUPATIONS

As you have already learned what plants are grown, what animals live, and what minerals are found in the different parts of the continent, you should be able to determine in a general way what are the occupations of the people. Mining, for instance, will not be an occupation of the Sahara, nor trading in rubber an industry of Cape Colony. There are nowhere any great manufactures, although various articles needed for local consumption are skilfully made by certain tribes.

The Barbary States include Morocco, Algeria, Tunis and Tripoli. The chief occupations are :—

(i) **Agriculture.** The chief products are esparto grass, tobacco, olive oil, wine, perfumes.

(ii) **Mining.** Iron, copper, lead, and salt are obtained in Algeria, and some quicksilver in Tunis.

(iii) **Manufactures.** Fez, the largest city in Morocco, makes the finest leather in Africa. It was once famous for “fez” caps, but these are now chiefly made in Austria, France, and Turkey. The *carmine* colour of the caps was got by using a dye obtained from the *kermes* insect. This insect was found in large numbers on the oaks on the slopes of the Atlas Mountains. Fez contains a slave-market where men, women, and children are still offered for sale.

Constantine is the largest inland town in Algeria. It is situated on the top of a high rock and has soap factories, where the refuse from the olive-oil mills is used.

Egypt.—(i) **Agriculture.** Cotton, maize, sugar, hemp, tobacco and fruits are the chief objects of culture.

(ii) **Manufactures.** Cotton, linen, and woollen goods and coarse pottery are made.

The Sudan is the home of the black man. He owes his colour to the heat and moisture, which have increased the amount of colouring matter in the blood. On the shores of the Gulf of Guinea, he is a stay-at-home man, engaged in the rearing of bananas and maize. He is an agriculturalist. Other Sudanese tribes are pastoral, or traders, or both.

A special form of occupation in the desert and the surrounding country is that of "caravan-leader." The caravan-leader is an expert who knows the position of every oasis and can find his way across the desert by means of signs that would mean nothing to other men. In his hands lies the safety of men and beast. When the caravan sets out, all do him homage. On its safe arrival at its destination all men load him with thanks.

Nigeria. Amongst the tribes of Nigeria there is one particularly intelligent race, the Hausas. They are the artisans and merchants of the west and of the centre of Africa. They are good blacksmiths, brass workers, tanners, dyers, and glass workers. They make cotton cloth at Kano, their chief town, and this cloth is sent all over Africa. Kano is surrounded by a wall, said to be twelve miles long. Here in the native market you can buy anything from an elephant's tusk to a slave.

A special occupation is that of "rubber expert." The rubber expert is generally a native of Yoruba. When rubber is wanted for export, a party of natives sets out under the guidance of the expert, to some place where rubber trees grow. On arrival, they offer a present of cloth to the local chief, and he then gives them permission to tap the rubber trees. The expert shows the natives how to set about the work, and what trees to work upon. A tree having been selected, a series of gashes is made in the bark, and the sap flows down these into a vessel set ready to receive it. When the vessel is full, it is heated over a fire. The rubber thickens into a hard, dark mass, and is exported in this form.

Eastern Africa. Here certain tribes are engaged in cattle rearing, but the Arab and Hindu population of the coasts are chiefly traders in ivory and slaves. In Uganda and other inland districts agriculture is practised. Some of the tribes smelt iron and copper, and make wire armlets and other ornaments.

Abyssinia. The natives manufacture woollen and cotton goods, metal goods and leather for their local needs.

The Congo Basin. Besides hunting, rubber-collecting and similar occupations of the forest, some of the tribes

smelt iron and copper ores, and with the metal they make wire, armlets, and other ornaments.

South Africa.—(i) **Cattle rearing.** The chief branch of this industry is sheep farming. The colony contains millions of sheep, but owing to want of care in management the wool produced is not as good as it might be. Horned cattle, horses, and goats are reared in hundreds of thousands. Ostrich farming is a profitable industry.

(ii) **Mining.** The mining industry is still a young one. Gold, diamonds, copper, coal and salt are found.

(iii) **Farming.** The excessive dryness of the climate in the Cape of Good Hope makes farming impossible except at scattered spots. Still, thousands of square miles might be reclaimed by irrigation, for the soil is fertile. In the south-west the vine is cultivated, but the wine is badly made.

Natal is the most fertile part of South Africa, and having a climate and vegetation almost tropical in character upon the coast, but of European character in the higher districts, all kinds of plants can be grown. Hence farming is one of the most important industries of the colony.

(iv) The **manufactures** of South Africa are unimportant. There is a lack both of fuel and of labour. There are plenty of natives but they do not love work in factories. The most useful artisans are the Malays, numbers of whom have settled in Port Elizabeth and Cape Town. They are also the fishermen of the colony. There are so many animals that hides are plentiful and good leather is made. As this industry is not dependent on abundant supplies of fuel, it will probably become a very important one.

Madagascar. The people weave silk, cotton and hemp into cloth. They make enough for their own use and also a small amount for export. Most of the **mat** bags used in the sugar industry of Mauritius are made in Madagascar.

REVISION EXERCISES

1. Describe the form of the floor of the North Atlantic. How do the deposits formed in the centre of the ocean differ from those formed on its margin ? C. S., 1906.

2. Select any five places and describe the situation of each and point out how geographical conditions have helped to make it important. Basel (Basle, Bâle), Belgrade, Budapest, Cöln (Cologne). Leipzig (Leipsic),

Lyon (Lyons), Mainz, (Mayence), Milan, Paris, Rotterdam, Rome, Salonica (Saloniki), Ulm, Vienna. L. J. S., 1904.

3. Draw a sketch map of the portion of Africa south of the Sudan showing the rivers Congo, Orange, Zambesi, the mountain Kilimanjaro, the Drakenberg Mountains, lakes Nyasa, Tanganyika, and the towns Boma, Cape Town, Durban, Ujiji. C. J., 1900.

4. Describe the West African coast from the Senegal to the Equator, naming the districts into which it is divided, the countries to which they belong and their principal products. C. S., 1905.

5. Mention the chief products of Algeria, Cape of Good Hope, Manitoba, Nova Scotia. C. J., 1900.

CHAPTER XXXIII

COMMERCE—PORTS

“AFRICA is the least important of all the continents with regard to external commerce. The indigenous industries are limited to the production of the barest necessities of life, or to the mere collection of the raw materials bartered or exchanged for European manufactures.” For this state of things the following causes are assigned :—

- (i) Natural unproductiveness.
- (ii) Backward state of civilization.
- (iii) Misgovernment, internal wars, and the slave trade.
(This applies only to a large part of the interior.)
- (iv) Defective means of communication.

There are, however, certain parts of the continent, in the extreme north and the extreme south, where the people are industrious, and where the natural resources of the country are being developed and utilized.

Cape of Good Hope. Nearly all the trade is with the United Kingdom. The chief exports are diamonds, wool, ostrich feathers, angora hair, copper ore, hides and skins, gold (from the Transvaal), wine and brandy. The imports are principally textile fabrics, articles of food and drink, hardware and machinery.

Cape Town, the chief port, the capital of the Cape of Good Hope, has the best harbour between St. Helena and

Mauritius, or between St. Helena and Albany. It is of vital importance to our navy as a coaling station, and a great breakwater has been erected to protect the harbour, while docks have been constructed that will take the largest vessels. It is the railway terminus of the proposed Cape to Cairo Railway.

Port Elizabeth. On what bay? This port has railway communication with the interior. There is no harbour, and the anchorage, though safe, will not admit the largest vessels. The damp heat on the coast makes Port Elizabeth an unhealthy place for Europeans. The wool of the colony is largely shipped from here, and there is also an export of mohair worth £500,000 per annum. Other ports are **East London** and **Port Alfred**.

Natal. Nearly all the trade of Natal is with the United Kingdom. The chief exports are wool, gold, sugar, coal, rum, skins, hides. Much of the wool and the hides come from the Orange Free State and the Transvaal, and almost all the gold from the Transvaal. The imports are chiefly iron and iron goods, machinery, textile fabrics and leather goods.

Durban is the only port. It is sheltered by a spur of land that juts out from the bay.

Zululand exchanges oxen and maize for cotton goods and hardware, which are brought into the country by traders from Natal, as the absence of any good landing-place prevents communication by sea.

Basutoland has good roads, and carries on an active trade with Cape Colony and the Orange River Colony. The exports are grain, cattle and wool, and the imports are blankets, ploughs, saddlery, clothing, iron and tin wares and groceries.

Bechuanaland sends considerable quantities of maize or "mealies," wool, hides, cattle and wood to Kimberley in exchange for textiles, hardware and other manufactured goods.

Rhodesia includes Southern Rhodesia, whose chief export is gold, and Northern Rhodesia, where rubber, copper, gold, and coal are obtainable, but where little development has as yet taken place.

The Orange Free State. Wool forms the principal article of export, and ostrich feathers provide an important and lucrative article of commerce.

The Transvaal. Owing to the immense number of sheep and cattle reared, wool and hides are largely exported, chiefly through Port Elizabeth and Durban. Ostrich feathers are also exported, but the chief export is gold.

Eastern Africa includes the coastlands from Delagoa Bay to the Gulf of Aden together with the uplands to the east of the Great Lakes. Name the most important divisions and say to whom they belong. The commercial productions include many articles of special value, but the total amount of trade is inconsiderable for so large a region.

Lorenço Marques. On what bay? This port has a magnificent harbour, sheltered from the south-east gales by a tongue of land. It has easy access to the Transvaal, and is the terminal port of the railway to Pretoria.

Mozambique is in Portuguese East Africa, and gives its name to the province. The town stands on a coral islet, which shelters the harbour. It has a through trade to British Central Africa, and also collects the products of several of the neighbouring ports for redistribution.

Chinde is the port of the only navigable mouth of the Zambesi, and here the river vessels meet the ocean steamers.

Dar es Salaam was the seat of government of German East Africa, now a British Mandatory Colony. It exports the produce of the colony: ivory, copal, gum, caoutchouc and sesame seed; and it imports cotton goods, glass beads, copper and brass wire, gunpowder and gin.

Mombasa is the seat of government and chief port of British East Africa. It is on an island, possesses the best harbour in East Africa, and is the terminus of the Uganda railway. The people of Uganda supply ivory, skins, cattle and goats, and other native products to Arab traders, in exchange for firearms and ammunition, woven fabrics, and other goods.

Zanzibar, for many years the centre of the East Africa slave trade, is splendidly situated on a fertile island, and

opposite some of the best inland trade routes. Its shallow roadstead is sheltered by the island on which the town stands. Much of the ivory, caoutchouc, etc., formerly sent to the Zanzibar market is now shipped direct to Europe from Mombasa, Dar es Salaam, and other coast ports; but it is still the great emporium, not only for the world-famous cloves of the islands of Zanzibar and Pemba, but also for the hides of Somaliland, the gums of the Swahili coast, and the ivory of East Central Africa.

Berbera, the port of British Somaliland, does a certain amount of transit trade.

The Nile Countries include Abyssinia, Egyptian Sudan and Egypt. From Egyptian Sudan, ivory and gum are the only valuable exports. Egypt exports to Great Britain raw cotton, cotton seed, sugar, beans, wheat, tobacco, and rice; and imports cotton goods, coal, iron and machinery.

Suakin is an important centre for the trade of the Red Sea. Like many other East African ports, Suakin is on a small island. It is the chief outlet for the commerce of Nubia.

Port Sudan is the terminus of the desert railway to the Nile.

Suez is the port at the southern end of the Suez Canal.

Port Said is a dirty coaling station at the Mediterranean end of the Suez Canal.

Damietta, on the east branch of the Nile delta, is the eighth largest town in Egypt.

Rosetta, on the west branch of the Nile delta, is now overshadowed by Alexandria, and is gradually losing its trade. The largest vessels cannot reach the harbour on account of a very inconvenient sand-bar. There are barrage works at Rosetta for the storage of the Nile waters.

Alexandria is the largest port in Egypt. The city was founded by Alexander the Great, 332 B.C. It has two large harbours and is joined to the Nile by a canal, and to all the important towns of Egypt by rail.

The Barbary States* include Morocco, Algeria, Tunis, and Tripoli. The chief exports of Northern Africa are wool, wine, cereals, esparto grass, gum, beeswax,

dates, olive-oil, and goat skins, which are exchanged for European manufactures.

Tripoli is the terminus of some of the chief caravan routes across the Sahara from the Sudan. It is the natural site for a political capital, but it has a shallow and dangerous harbour. Tripoli prepares feathers for Paris, ivory for London, and goat skins for New York.

Tunis. Of what country is this the capital? The town stands on a small lagoon at the head of the Bay of Tunis, about three miles from the ancient city of Carthage. Its bazaars are crammed with Oriental goods and fruit. A ship-canal connects the capital with the port **Goletta**.

Bizerta is the most northerly town in Africa. It has a magnificent harbour, which is now used by the French as a naval station.

Algiers. Of what country is it the capital? There is a new town and an old town. The new town has been built by the French and has fine shops and streets. Algiers is an excellent half-way house from London to Port Said. It has a splendid harbour, two good docks for repairs, large supplies of fresh fruit and provisions, and room for coal, timber, wine casks and other bulky goods.

Oran is another busy seaport in Algeria.

Tangier. On what strait? It is the port for the north of Morocco.

Mogador is the port for the south of Morocco.

The Sahara exports dates, salt, ostrich feathers, and gold dust. The commerce of the Sahara, where there are neither roads nor waterways, is carried on by camel-caravans, which cross the desert by certain routes, the directions of which are determined by the positions of the wells and oases. The goods obtained in exchange for the products of the Sahara are cotton goods and other textile fabrics, cutlery, arms, and all sorts of trinkets.

The Sudan. The commercial productions of the Sudan are chiefly gold dust, gum, ivory and ostrich feathers. The trade is chiefly in the hands of the Moors, and is carried on by means of caravans.

Western Africa includes all the countries from Cape Verde to Cape Frio. The commercial productions

include gold dust, ivory, ostrich feathers, palm oil, beeswax, india-rubber, and various gums. These products are chiefly obtained from the regions of the Senegal and the Gambia and the line of the Guinea Coast. The trade, which is in the hands of the English, French, and Germans, has increased very much within recent years.

St. Louis is the political capital of the French possessions in Senegambia, and is situated on a low island in the Senegal, near its mouth. Here the natives barter palm oil, ground nuts, gums, india-rubber, ivory, and skins, for cotton goods, beads, trinkets, and metal wares.

Bathurst is the capital of the Gambia. At the mouth of what river is it? The staple export is ground nuts, but beeswax, india-rubber, and hides, are also exported, chiefly to Marseilles.

Freetown is the capital of Sierra Leone. It has the best harbour in West Africa and is an important British naval and coaling station. It is the half-way house between England and the Cape. The exports are similar to those of Bathurst.

Monrovia is the capital of Liberia and exports the excellent coffee grown in this state.

Cape Coast Castle is one of the ports of the Gold Coast.

Accra is the capital and chief port of the colony. The principal exports of the Gold Coast Colony are palm oil, palm kernels, and india-rubber.

Lagos, the capital of Lagos, is the largest town and most important port in all West Africa. The harbour is insecure, and large steamers have to tranship their cargoes to smaller vessels. Lagos was formerly one of the chief slave markets on the Guinea Coast, but the trading stores and factories now exchange guns, cloth, tobacco—"anything from a fish-hook to a cask of rum"—for palm oil and kernels, cotton, ivory, gum copal, etc.

Akassa is the distributing centre for Nigeria. Most of the exports go to Liverpool.

Libreville is the chief port for the French Congo.

Boma, the seat of government of the Belgian Congo, is on the river, about 50 miles from the sea.

Loanda, the chief port in Angola (Portuguese West

Africa), is also the seat of government of the colony. It contains a larger white population than any other town on the West Coast of Africa.

Other ports in Angola are **Benguela** and **Mossamedes**.

Madagascar exports cattle, india-rubber, hides, coffee, sugar, vanilla, gum copal, rice, etc., and imports cotton goods, spirits, metal goods, and earthenware. Most of the trade is carried on with France.

Mauritius exports sugar, rum, vanilla, aloe fibre, molasses, coco-nut oil.

Port Louis is the capital and chief port.

As an interesting and useful revision exercise enter the following tables in your note book. You can find most of the details for Table II in a Shipping Guide, or even at the end of the A B C Time Table. You may be able to get from the several shipping companies small maps of their routes. If you can obtain any of these, fasten them in your note books.

TABLE I.

Port.	Country.	To whom does the country belong.	Imports.	Exports.

TABLE II.

Port.	Lines of Steamers from England.	Port of Departure.	Length of Voyage.	First Class Fare.

REVISION EXERCISES

1. How are the tides produced? What is the difference between spring tides and neap tides, and how is this difference caused?

C. S., 1906.

2. If you were told to find out *the best way* of sending goods from one place to another, what points should you inquire about? Illustrate from the cases of: (a) sending a library of books from London to Edinburgh, (b) sending a parcel of watches from Geneva to Brussels.

O. J., 1897.

3. On a map of South Africa insert and name the chief mountain ranges and rivers. Draw the boundaries of the Cape, the Transvaal and Orange Free State, and Natal. Indicate the chief districts in which (a) gold, (b) copper, (c) diamonds, (d) coal are found, naming the chief towns in each district. ...Insert Delagoa Bay, Pietermaritzburg, Bloemfontein and three important British ports. Number the lines of latitude and longitude.

O. S., 1905.

4. Give the position of the following places, stating for what each is noted: Ceuta, Cork, Dundee, Londonderry, Mafeking, Merthyr Tydvil, Pietermaritzburg, Timbaktu. State what you know of the Great Karroo, the Victoria Falls. What time is it at Cairo when it is noon at Greenwich? Account for the difference.

C. J., 1905.

5. Name in order from north to south the great lakes of Africa. What are the chief exports of Africa. For what is each most used?

O. J., 1890.

6. What would you consider the advantages of opening up trade with tropical regions such as Central Africa?

O. J., 1898.

CHAPTER XXXIV

RAILWAYS

THE railways of Africa are very few in number, and not of nearly the same commercial importance as the great main lines of Europe, and the Trans-continental systems of North America. Only South Africa, Egypt and Algeria are at all well provided with railways. When great highways are built they will run north and south, and not east and west.

Insert the following lines on a blank map marking all towns, etc. :

Algeria. The railways in Algeria have been built by the French.

(i) **Algiers.**—The railway runs through the fields and vineyards of the Tell, passing villages of very French appearance, and then enters that part of the Atlas region where the Kabyles live. The Kabyles were driven out of the plains and into the hills by the Arabs thirteen hundred years ago. They are handsome and intelligent. The women are tall and graceful and do not veil their faces. The men like work and make good farmers, artisans, and manufacturers.

The line mounts to the plateau, crossing dried-up river beds in the summer, and roaring torrents in the winter. It then speeds over the flat tableland where the thin grass feeds large flocks of sheep.

Setif, a strong fort in the days of the Arab occupation, is now held by French troops. From Setif the line runs from the plateau to the desert, passing the salt "shots." The grassy plain gives way to barren steppe, and bare red rocks and tracts of sandy ground come into view. The hills close in on either side of the railway which now passes through the famous gorge of **El Kantara**. Here there is a beautiful and fertile oasis.

Biskra. This is the end of the line. It has become popular as a health resort, as it has one of the finest climates in the world. Here the railway meets the caravan, and the stylishly dressed European lady bargains with the turbanned

Arab. The natives dance barbaric dances under the electric light, and European hotels are crowded with visitors attracted by African skies and date-palms.

(ii) **Oran.**

Algiers.

Constantine. This is the capital of Eastern Algeria and the chief grain market of the country. A branch runs to its port, Phillipeville, forty miles away.

Bona is another port.

Tunis is the capital of the French protectorate.

Egypt and the Cape to Cairo Railway. The idea of a railway through the heart of Africa was that of the great South African statesman, Cecil J. Rhodes. He dreamed of this railway all his life and he took many practical steps towards realizing his dream. "It would be the backbone and spinal cord, to direct, consolidate, and give life to the numerous systems of side railways which will connect the vast central road with the seas on either hand."

Alexandria was the capital of Egypt many years ago and the greatest commercial city in the world. When the Cape route to India was discovered it declined in importance. It has since regained a little of its former prosperity but it is still only a second-rate port.

The railway runs over the flat Nile delta through a network of canals and river branches. Wheat, cotton, and rice, are to be seen on either hand.

Cairo is the capital of modern Egypt and the largest city in Africa. It stands at the head of the Nile delta, and has a great university with over 2,000 Mohammedan students. In the winter the climate is dry and healthy. The city has many mosques or temples, with numerous domes and minarets, and the Moslem priests can be heard from time to time calling out to the faithful the hours of prayer. Not far from Cairo are the world-famed pyramids, which were the burial places of the ancient kings and nobles. An electric tram connects Cairo with the pyramids. There is a branch railway line to Ismailia.

Thebes has remains of ancient temples. The dry air of the country has been very favourable to the preservation of her ancient monuments.

Assuan is where the big dam has been constructed.

Wadi Halfa. Here the cataract breaks the navigation of the Nile.

Berber. This town is connected by rail with the nearest port on the Red Sea. What is this port? What river joins the Nile not far from Berber? Standing as it does near the junction of these two rivers, Berber is a great caravan centre.

Khartum is the terminus of the Egyptian-Sudanese Railways and is now becoming of great importance as a trade centre. It has railway connection with Egypt, is on a navigable river, and is the terminus of caravan routes from all directions.

From Khartum there is steamer communication up the Nile to **Gondokoro**. It is proposed to take the railway line to **Kodok** (Fashoda). From Kodok southwards several routes have been proposed which would make use of one or more of the many navigable rivers and lakes. The line will ultimately traverse East Central Africa, running through British territory all the way, and will join the section coming from the Cape of Good Hope. The southern portion of this important railway has been already carried beyond the northern boundary of Northern Rhodesia.

Bulawayo. The line runs from Bulawayo to the Falls in order that it may tap the vast coal deposits near the Zambesi. Bulawayo is in Matabeleland. Lobengula, the last Matabele chief, was defeated here in 1893. There was then a native kraal on the spot. To-day there is a British town with a mayor and corporation, newspapers, clubs, hotels, and parks. Not far away, on the Matoppo Hills, in a rock tomb, lie the remains of Rhodes, the founder of Rhodesia.

Mafeking is in Bechuanaland. It is the largest town and controls the trade north and south.

Vryburg.

Kimberley. What is found here? Running south, what river is crossed near latitude 30° S.?

De Aar. Here a line runs off to Port Elizabeth. From De Aar to the mountains we pass through farms, horse-breeding centres, and sheep-rearing districts. What mountains are crossed?

Beaufort West. This is a wool centre, and has a sheep

and cattle market. From De Aar to Beaufort West the soil is rich, but the rainfall is too slight to allow of agriculture, except where the land can be irrigated. What desert do we cross after leaving Beaufort West? It is covered with dried-up shrubs and low heathery bush on which sheep are fed. Except on the banks of dry gullies there are no bushes more than 2 feet high. The sheep farmer often spends much money boring artesian wells. While there is water he does well. If water fails, his sheep die, and he loses all his money in a few weeks.

From the desert we descend by steep gradients amongst magnificent mountain scenery.

Worcester.

Cape Town.

There are three chief lines of railways in the Cape.

(i) The Western. This is the one we have already described as the southern section of the Cape to Cairo route.

(ii) Midland.

Port Elizabeth.

Graaf Reinet (the "Gem of the Desert") is an oasis on the Karoo where fruit trees are grown in large numbers. It manufactures coarse brandy. In the neighbourhood of this town most of the goats are reared.

Rosmead Junction. This is an important railway junction. Another branch of the Midland which also starts at Port Elizabeth joins the line here. What mountains are crossed beyond this point? What river, as the railway makes for Bloemfontein?

Bloemfontein ("Flower Town") is the capital of the Orange Free State.

Kroonstad. After leaving Kroonstad the Vaal is crossed. What state is entered?

Johannesburg is the largest town in the state. Find from your map with what port in Natal it is connected by rail. By other branches it can reach Cape Town and East London, Pretoria and Delagoa Bay.

Pretoria is the capital of the Transvaal. With what port on Delagoa Bay has it railway connexion?

Pietersburg. Near what mountains does this town stand?

AFRICA—RAILWAYS

A branch from Port Elizabeth runs to **Grahamstown** where feathers and cattle are sold. It is the most English-looking town in Cape Colony.

(iii) The Eastern.

East London has a mere roadstead, not a harbour.

King Williams Town (on a short branch). This is in the centre of a good cattle and sheep country. Its port is East London. The line joins the Midland just after crossing the Orange River.

Natal. There are 800 miles of railway in Natal. This colony was the first part of South Africa to introduce railways.

Durban is the chief seaport and the largest town in Natal.

Pietermaritzburg is the capital of Natal. It is 200 feet higher than Durban, on the lowest of the terraces of which Natal is formed.

Ladysmith is famous for its long siege in the Boer War.

Majuba Hill.

Johannesburg.

The work of making such a railway as this is of considerable difficulty, as the country rises in steep terraces. But it is an exceedingly important line, as it passes through a series of districts, each of which has produce for the line to carry. On the coastal plain, sugar, rice, cotton, bananas and pineapples grow. On the next terraces are orchards, well tilled fields, and oak forests. Higher still, is the pasture land for sheep and cattle. It is with great truth that Natal has been called the "Garden of South Africa."

Amongst the shorter railways are the following. They are all important, as opening up various parts of the interior of the continent to traders:—

(i) **Mombasa to Victoria Nyanza.**

(ii) A railway has been built from Jibuti, a port on the French Somaliland coast, to Addis Abeba, the capital of Abyssinia, and another is building between Zeila and Hatat.

(iii) In Belgian Congo, a railway connects Matadi and Stanley Pool, between which places the navigation of the Congo is impeded by cataracts.

(iv) In West Africa an important line connects the

Senegal and the Niger ; another links the Upper Niger with the coast ; and there are also railways from Lagos to the interior.

(v) In Angola, a line runs from Loanda into the interior.

(vi) In what was German South-West Africa, now administered by the Union of South Africa, the capital, Windhoek, is connected with the coast.

REVISION EXERCISES

1. Given a genial climate the flood plains and deltas of great rivers are amongst the most densely populated regions of the world. What are the conditions which account for this ? Justify the statement by examples and describe the occupations and mode of life of the inhabitants.

O. S., 1906.

2. How do the climates of England, Newfoundland, and Manitoba differ from one another ? What explanations can you give of the differences ?

O. J., 1905.

3. On a map of Africa draw the boundary lines of Algeria, Belgian Congo, Egypt ; insert the equator, the rivers Niger, Nile, Zambesi ; Lake Nyasa ; Capes Palmas, Delgado ; Algoa Bay ; Gulf of Gabes ; Berbera, Khartum, Kilimanjaro.

O. S., 1893.

4. Give an account of Africa, south of the Zambesi, describing its physical features, mining centres, chief railways and ports.

C. S., 1905.

5. State what you know of either the Congo or the Nile. Give the sources, course, chief tributaries, countries traversed, and any impediments to the navigation of the river selected.

C. S., 1905.

CHAPTER XXXV

POLITICAL DIVISIONS

THE manufacturers of Europe are always on the look-out for new markets for their wares. Whenever a fresh district is explored there is a race for territory. Africa, having no strong rulers, or armies, easily fell a prey to European nations. The chief competitors in the race for Africa have been the English, French, and Germans, Britain has less territory than France, but that which she possesses is more temperate, more fertile, and more accessible by river, and is therefore more valuable. To avoid armed conflicts among themselves, the various European nations have agreed to recognize certain "spheres of influence," that is, regions in which one European Power is allowed to

trade, to conquer, and to govern, without opposition from the rest. The race is now practically over, as the great Continent has been parcelled out amongst the various nations, and there is little African territory left that is worth striving about.

Take a blank map of Africa and insert the boundaries of the following countries. Insert the capital in each case. Colour the possessions of each European Power with a distinct colour, and on the margin of the map place a list of the colours and the nations, showing by what colour each nation is represented.

British Africa

The Union of South Africa, constituted in 1909 and formally inaugurated in 1910, consists of four Provinces—the Cape of Good Hope, Natal, the Transvaal and the Orange Free State. These are termed the original Provinces, but it is provided that Rhodesia may be admitted to the Union.

The Union Government has as its executive head the Governor-General appointed by the Sovereign. The legislative authority is the Union Parliament, consisting of a Senate and a House of Representatives. In each of the Provinces there is an Administrator appointed by the Governor-General, and an elected Provincial Council.

The Parliament of the Union sits at Cape Town, but the administrative offices of the Government are at Pretoria.

The former colony of German South-West Africa has now become a "Mandatory Colony" of the South African Union. It is a generally uninviting region, where there are no roads, paths, coal or industry. It was a commercial failure during the German occupation, but may expect better days under British administration.

Rhodesia is administered at present by the British South Africa Company. This company undertakes to develop the resources of the country, and to promote and aid immigration.

Basutoland is a Crown Colony.

British West Africa. The Gambia, *Sierra Leone, the Gold Coast, Northern Togo (part of the former German Colony of that name), Nigeria including Lagos.

These are all British Crown Colonies ; that is, they are under the direct control of the Imperial Government, and the administration is carried on by governors and officials appointed by the home authorities.

British East Africa. East Africa and Uganda Protectorates, Zanzibar and Pemba, with the Northern Somali Coast and former German East Africa.

These form a group of protectorates. Protectorates retain a considerable measure of internal independence, under the general direction of British officers, but in their external relations they are completely under British control.

The former Colony of German East Africa has been handed over to the trusteeship of Great Britain, who hold a mandate from the League of Nations to govern the country upon the principle "that the well-being and development of peoples not yet able to stand by themselves 'form a sacred trust of civilisation.' " The country is a superb region, but haunted by deadly fevers, especially along the coast, and acclimatization, even in the interior, will always be extremely difficult.

British Insular Africa. Mauritius, the Seychelles and Amirante Islands, Sokotra, St. Helena, Ascension and Tristan d'Acunha.

Mauritius, St. Helena and the Seychelles are Crown Colonies, but Ascension Island is under the Admiralty.

The Amirante Islands form part of the government of Seychelles. Sokotra is under the government of Aden.

Egypt and Egyptian Sudan. Egypt has virtually been controlled by Britain since 1883, and in 1914 a formal British Protectorate was declared. The native ruler of Egypt, who is called the Khedive, was formerly subject to Turkey.

French Africa

1. **Algeria and the Protectorate of Tunis.** Algeria is regarded rather as a detached part of France than as a colony or dependency. The affairs of Tunis are administered by the French Foreign Office, through the French Resident stationed at the capital.

2. **French West Africa** consists of Senegal, French Guinea, the Ivory Coast, Dahomé, part of Togo, and the Military Territories of the Niger and Mauritania.

3. **French Equatorial Africa** (French Congo) includes the Gabun, Middle Congo and Ubangi-Shari Colonies, the Chad Military Territory, and the greater part of the former German Colony of the Cameroons, which is now administered by France under a Mandate from the League of Nations.

4. **Madagascar.**

5. **French Somaliland** (French East Africa).

6. **Reunion** or Bourbon, has been a French Colony since 1764.

7. **Morocco.** In 1911, by arrangement with the Great Powers, France assumed a Protectorate over the whole of Morocco excepting the coast district south of Gibraltar, which was assigned to Spain. Morocco was formerly an "Empire" under the rule of a despotic Sultan, though his authority, even at its height, was scarcely acknowledged by some of the chiefs of the semi-independent tribes in his dominions.

Portuguese Africa

1. **Portuguese Guinea.**—Although the rivers afford easy access to the interior, little is done by the Portuguese to develop trade.

2. **Angola** (Portuguese West Africa).

3. **Portuguese East Africa** is governed by a Governor-General, who has a colonial military force and a small navy. The authority of the Governor does not extend far from the fort and the towns, and the colony has so far proved a heavy financial burden to Portugal.

4. **Madeira, Cape Verde, St. Thomas and Prince's Islands.**

Spanish Africa

The Spanish possessions are unimportant. They include Ceuta, and Tetuan in Morocco, the Saharan Coast, the district round Corisco Bay and the islands of the Canaries, Fernando Po and the Riff district on the southern shore of the Strait of Gibraltar.

Italian Africa

1. The **Eastern Somali Coast**.
2. The Province of **Eritrea** on the Red Sea.
3. **Tripoli** (or *Libia Italiana*). The annexation of Tripoli by Italy was a consequence of the war between Italy and Turkey in 1911–12. The Sultan retains, however, the religious headship of the Mohammedan inhabitants.

Belgian Congo

The **Belgian Congo**, under the name of the Congo Free State, was under the sovereignty of the King of the Belgians from its foundation in 1882 until 1908 when it became a national colony under the name of the Congo Belge. In 1919 the Ruanda district, in the north-west of what was formerly German East Africa, was acquired by Belgium.

Independent

Abyssinia, or Ethiopia, was formerly a powerful State, governed by an absolute ruler, the “King of Kings.” It was for some years an Italian Protectorate, but has now regained its independence.

Liberia is a Negro Republic. It is governed by a President and two Houses of Parliament. The republic was founded in 1882 as a place of refuge for freed slaves, and it was at one time hoped and believed that, freed from the restraints under which they had suffered for so long, they would gradually realise a higher state of civilization. As a matter of fact, they have almost relapsed into barbarism.

There are a number of independent native states in the country, but these are not of sufficient political or commercial importance to be dealt with here.

The Former African Possessions of Germany and Turkey

As a result of the Great War Germany and Turkey have been driven from Africa. The former African Colonies of Germany have been assigned under Mandates from the League of Nations as follows: German East Africa to

Great Britain, except the north-east district of Ruanda, which has been assigned to Belgium ; German South-West Africa to the Union of South Africa ; the greater part of the Cameroons to France, the northern frontier districts being placed under a British Mandate ; and Togo, the northern half to Great Britain and the southern half to France.

Turkey's nominal suzerainty has been abandoned over Egypt, which is now a British Protectorate.

REVISION EXERCISES

1. State generally the geographical conditions which favour the growth of large modern seaports.* Illustrate your answer by examples.

O. S., 1906.

2. On a map of Africa trace the course of the Congo, the Orange River, and their tributaries. Insert Lake Nyasa, the Transvaal, Tunis, the Bight of Biafra. Mark and name Kilimanjaro, Tripoli, Assuan, Cape Coast Castle, Kimberley.

O. J., 1888.

3. Write a brief description of :

(a) The means of communication between the Transvaal and the coast.

(b) The trade of the West African Colonies.

(c) The climate of the Cape of Good Hope.

O. S., 1905.

4. Give a short account of the physical geography of the Cape of Good Hope.

O. J., 1905.

5. Name the States bordering on the north of the Gulf of Guinea and describe their climate and physical features. State the principal commercial products derived from them and name the chief places of export.

C. J., 1905.

6. Mention the chief natural features, political divisions, towns, and anything of special interest that would be passed by a traveller going by land from Cape Town to Cairo, and state approximately the distance between these two towns.

C. J., 1905.

CHAPTER XXXVI

THE PEOPLE

EXAMINE the map showing the distribution of population (Fig. 47). What parts have a population under 1 per square mile, between 1 and 8 per square mile, between 8 and 32 per square mile, between 32 and 64 per square mile ? Notice the patches scattered over the Sahara where a population between 1 and 8 per square mile is found. What would you expect to find there ? What would you expect to see growing there ? What is the population of

the Nile valley ? of the Niger valley ? Why should there be a denser population in these parts than in many others ? What other parts of the continent have a population as dense as that in the valley of the Nile ? Account for these. Examine the map (Fig. 48) which shows the distribution of the races of Africa. Some of the names are probably unfamiliar to you. The original inhabitants were the Hottentots, Bantus, and Negroes. The Egyptians, the Arabs and the Abyssinians came later. The latest invaders of all were the Dutch, English, French, Germans, etc.

Beginning at the south-west corner we find there the Hottentots and the Bushmen. The **Bushmen** are descended from the earliest inhabitants and they were driven into this corner by other races who rose to power in the course of the centuries. They are a debased people and are now almost extinct. They are hunters, who shoot with poisoned arrows. When they cannot get flesh, they will eat roots, berries, ants, locusts, and snakes.

The **Hottentots** are more numerous than the Bushmen, but they too are declining in numbers. They are cattle farmers, and nomadic in their habits. They are very short, not at all strong, have small hands and feet, flat noses, high cheek bones, and woolly hair. They are yellowish in complexion. They live in circular bee-hive shaped huts called kraals, and, like the Bushmen, use poisoned arrows when hunting.

The Bantu races live in the middle of Africa. Their limits are roughly the parallels of latitude 30° S. and 6° N. They are lighter in colour than the negroes and have woolly hair. There are many Bantu tribes, of whom the chief are the **Kafirs** and the **Zulus**. The Kafirs, the most numerous, are handsome dark-brown people. They dress in leopard skins, ox-hides, and blankets, but they are particularly fond of cast-off European clothes, especially when these have a little gold or silver braid upon them. When the Kafirs fight they use assegais or throwing spears, and heavy sticks with knobs at the end called knob-kerries. The chief occupation of these people is cattle raising. They also do most of the manual labour in the eastern and central parts of our South African colonies.

The Zulus, who were so dreaded in South Africa because of their military power, were a tribe of Kafirs. Amongst all the Kafir tribes the hard work of the fields is done by the women; the young men look after the cattle, while the old men hunt, talk, smoke, and take things easily. The Kafirs are extremely superstitious, believe in ghosts, and worship snakes. Their language is very melodious and not full of "clicks" like the language of the Bushmen.

Negroes. There are many tribes of negroes and many types. In the Sudan they are jet-black, well-built, good-looking, but in some other parts they have light hair and complexions. Some of the "fair negroes" are cannibals. The negroes are like over-grown children, vain, fond of pleasure, and given to idleness, but generally good-natured. Their homes are huts of mud, reeds, or grasses. They wear but little clothing. They worship animals and believe that the bodies of these animals are often inhabited by human spirits. The northern boundary of the dark people is a line drawn east from Cape Verde almost to the opposite side of the continent. North of the line are various races belonging to the white or Caucasian races. The two chief peoples are the Hamites and the Semites, who are named after two of Noah's sons. The Hamites live in Egypt, Algeria,

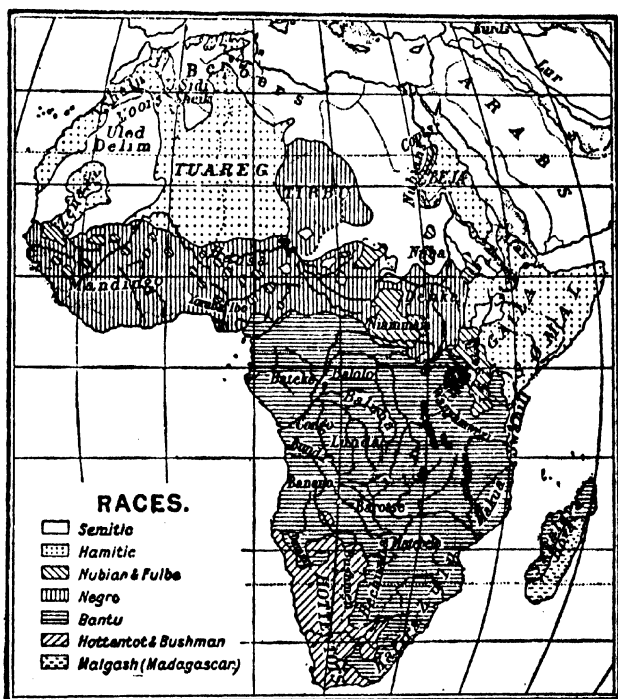


FIG. 48.—AFRICA: NATIVE RACES.

Morocco, parts of the Sudan, and in the eastern horn of Africa. Find from your map by what different names they are called in different parts of the region which they inhabit. The Semites are the Arabs of the north and north-west and the inhabitants of Abyssinia. Both Hamites and Semites have oval faces and well-formed features. They are chiefly pastoral as they dwell in dry regions.

The inhabitants of Madagascar are of mixed Malay and African blood. The chief race is that of the Hovas. They ruled the island till it was conquered by the French. They are lighter in colour than the other races, are lawless, untruthful, and cruel in war, but kind to children, the sick, and the aged; good friends, but bad enemies.

Religions. Most of the dark races are fetichists. A fetich is any natural object or any graven image in which a spirit is supposed to dwell. Anything can be a fetich, from a splinter of wood or a bit of feather to a mountain or a waterfall. The black man prays to his fetich, but if he does not get what he wants, he beats and kicks it to make it a little more obedient.

In Egypt there is a race of men called the Copts. They are the descendants of the ancient Egyptians. Both the Copts and the Abyssinians practice a form of Christianity, but it is of a very debased kind. On their great feast days the Abyssinians gorge themselves on raw steaks cut from the living ox, and drink copious supplies of beer.

The Arabs are chiefly Mohammedans.

The Dutch settlers of the south are Protestants.

REVISION EXERCISES

1. Explain why the length of a degree of latitude is nearly the same in all latitudes, while that of longitude diminishes as latitude increases.

O. J., 1906.

2. How is each of the following states governed: Abyssinia, Egypt, Tunis, Algeria, Liberia? Give the capital of each.

C. J., 1895.

3. What parts of Africa are most densely peopled and which have fewest inhabitants? Give reasons for this. Name and describe the position of three towns in Africa which are not on the sea-coast.

L. J. S., 1906.

4. State what you know of the physical features, climate, inhabitants of the Transvaal. Give its chief productions; also name four of its principal towns.

C. J., 1905.

5. Define the portion of Africa inhabited by the negro races. In what parts of Africa is Mahomedanism predominant?

C. S., 1889.

